

Systematics of geophytic *Othonna* (Senecioneae, Othonninae)

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APPENDICES: PUBLICATIONS

1: Magoswana S.L., Boatwright J.S., Magee A.R., Manning J.C. 2016. A taxonomic revision of *Gymnodiscus* (Asteraceae: Senecioneae: Othonninae), a Greater Cape Floristic Region endemic. *South African Journal of Botany* 106, 71-77.

2: Magoswana, S.L., Manning, J.C., Magee, A.R., Boatwright, J.S., 2017, *Othonna sonchifolia* L. is an earlier name for *Senecio cymbalarifolius* L. (Asteraceae: Senecioneae), *Bothalia* 47 (1), 1-4.

DEDICATION

This dissertation is dedicated to the memory of my late dear mother, Lulama Ruth Magoswana who unfortunately passed on to glory during the completion of this project. She was a constant source of inspiration in my life, a fountain of wisdom and my source of strength, a pillar in my life. Although she is not here, I always feel her presence that carried encouragement to strive and achieve my goals in life.

Lala ngoxolo Jola, Qengeba, Mphankomo ugqatso ulufezile! Singaka nje ngamandla akho naloThixo wawusoloko usifundisa ngaye. Undizimele ndisabuka kodwa s'thandwa sam! Ndiyathemba uThixo ekubizele kuye nje uyasazi isizathu soko kwaye singaphezulu kunoba sicinga thina. Wonwabe apho, sohlala sikuthanda kwaye sikukhumbula. Elona themba sinalo lelokuba sizakuphinda sibonane.

Systematics of geophytic *Othonna* (Senecioneae, Othonninae)

SUMMARY

A member of the Senecioneae subtribe Othonninae, *Othonna* L. is a genus of some 120 species mainly concentrated in the Greater Cape Floristic Region (GCFR) of South Africa, with a few species extending into southern Namibia, Angola and Zimbabwe. The South African species of *Othonna* were last revised by Harvey in 1865. Consequently many species, particularly in the winter rainfall-region, remain poorly understood. As a start to ultimately producing a complete revision of this priority genus, this study focussed on a group of some 26 tuberous geophytic species. The geophytic species were subdivided into two species groups: (1) the '*O. bulbosa*' group with 23 spp., distinguished by a tuberous rootstock and well-developed stem with leaves cauline, and (2) the '*O. auriculifolia*' group with ca. 3 spp., characterized by a rosulate habit with a short, condensed caudex.

A comprehensive taxonomic treatment of the '*O. bulbosa*' group is presented, including descriptions, complete nomenclature and typification, illustrations and geographical distribution. Twenty-three species are recognised, of which two are newly described (*O. lilacina* Magoswana and J.C. Manning and *O. sinuata* Magoswana and J.C. Manning), and 17 names reduced to synonymy. The species were found to differ in habit, foliage shape, number of involucral phyllaries, pappus length, capitulum type (radiate vs. disciform), and myxogenic or non-myxogenic fruits. The species can be segregated

among four morphologically diagnosable groups based on habit, capitula type and ray colour: the series *Bulbosae* Magoswana and J.C. Manning, distinguished by radiate capitula and yellow ray florets; series *Roseae* Magoswana and J.C. Manning, with radiate capitula and pink to magenta ray florets; series *Disciformes* Magoswana and J.C. Manning, with disciform capitula, and filiform, female-fertile outer florets, and the pappus of the marginal florets enlarging to twice the length of the cypselas; and series *Perfoliatae* Magoswana and J.C. Manning, with scandent or sometimes erect stems, the leaves strictly cauline and scattered evenly along the stem, sessile and clasping or auriculate

The phylogenetic relationships of the geophytic species of *Othonna* were assessed through parsimony and Bayesian analyses of both nuclear ITS and plastid (*rps16*, *trnL-trnF*) regions. Phylogenetic analyses of the nrITS and combined datasets indicate that the '*O. bulbosa*' group is monophyletic. However, in the plastid dataset, the group was not recovered as monophyletic. The phylogenetic sampling of *Othonna* is expanded to include 26 species of the genus, nine representing the '*O. bulbosa*' group. Species belonging to the '*O. auriculifolia*' group were not recovered with the other geophytic species and also not close to one another.

CHAPTER 1

INTRODUCTION

Senecioneae Cass. are currently recognised as the largest tribe in Asteraceae, comprising ca. 160 genera and ca. 3 000 species (Nordenstam et al., 2009). The tribe has an almost cosmopolitan distribution, with centres of diversity in South America (ca. 1 300 species) and southern Africa (ca. 700 species). Members of the tribe are represented in almost all habitats, from deserts to vernal pools, from seashore to alpine communities, and from arctic regions to the tropics (Bremer, 1994; Pelser et al., 2007). The tribe displays enormous variation in morphology and life-history strategies and is considered to be the most diverse tribe in the Asteraceae (Pelser et al., 2007). Members of the tribe are mostly annual or perennial herbs but some are shrubs, vines, trees or epiphytes (Pelser et al., 2007; Nordenstam et al., 2009). Despite its large size and diversity, members of the Senecioneae are readily circumscribed morphologically by an involucre of uniseriate (rarely biseriate) bracts (sometimes called phyllaries) (Pelser et al., 2007), and chemically by the presence of pyrrolizidine alkaloids and sesquiterpenes of the furanoeremophilane type (Bremer, 1994; Kadereit and Jeffrey, 1996; Pelser et al., 2005).

In an attempt to circumscribe and delimit the Senecioneae, different approaches have been followed by various authors in the past. As such, the tribe has experienced expansions and contractions as groups of genera have been moved in and out. Consequently, no satisfactory, natural subtribal classification yet exists, largely because

a comprehensive view of the evolutionary relationships in the tribe is still lacking (Pelser et al., 2007). Cassini (1819) was the first to propose the subdivision of the tribe, recognising three subtribes, viz. Senecioneae, Tussilagineae Less. and Adenostyleae Cass. Lessing (1832) and Candolle (1836-1838) recognised eight subtribes, but Bentham (1873) reduced the number of subtribes to four in a system that was somewhat similar to that initially proposed by Cassini (1819), recognising the same number of subtribes but included Liabeae Rydb. as one of the four subtribes in addition to other helianthoid (or helenioid) genera such as *Arnica* L., *Neurolaena* R.Br., *Psathyrotes* A. Gray, and *Schistocarpha* Less. Nordenstam (1977) analysed 18 characters from morphology, anatomy, embryology, cytology, and chemical evidence, providing support for the recognition of three subtribes (Othonninae Less., Senecioninae Cass., and Tussilagininae (Cass.) Dumort.) excluding *Arnica* (and all other helenioid genera previously added by Bentham (1873)) and Liabeae Rydb.

The size and wide distribution of the Senecioneae has made adequate sampling difficult for modern DNA-based analyses, and most such studies have focussed on resolving the relationships among selected genera and species, thereby fragmenting the knowledge of subtribal relationships (Nordenstam et al., 2009). Recently, as a first phylogenetic hypothesis of evolutionary relationships in the tribe, Pelsner et al. (2007) analysed nrITS and plastid DNA (*psbA-trnH*, *trnK*, *trnL-trnF* and *ndhF*) of 614 representatives from 114 genera of the Senecioneae which included 186 *Senecio* L. species. Based on this analysis, they recognized four subtribes: Abrotanellinae, Tussilagininae (which they mention may need to be split into three or four subtribes (all to be recognised at subtribal level)), Othonninae and Senecioninae. The splitting of the

subtribe Senecioninae by Pelser et al. (2007) led to the recognition of the subtribe Abrotanellinae making this classification different from that of Nordenstam (1977) who recognised three subtribes (Othonninae, Senecioninae and Tussilagininae).

The subtribe Othonninae is the smallest of the currently recognised subtribes and is primarily southern African in distribution (Bremer, 1994; Devos et al., 2010). Six genera are recognised within the subtribe, viz. *Crassothonna* B.Nord. (13 spp.), *Euryops* (Cass.) Cass. (97 spp.), *Hertia* Less. (ca. 10 spp.), *Lopholaena* DC. (ca. 20 spp.), and *Othonna* L. (ca. 120 spp.) (Pelser et al., 2007; Nordenstam et al., 2009; Devos et al., 2010).

The nominate genus *Othonna* is one of the two largest within the Othonninae, with about 120 species currently recognised (Devos et al., 2010; Nordenstam, 2012). The genus is highly polymorphic, consisting of tuberous herbs or semi-succulent shrubby perennials largely confined to southern Africa with a substantial representation in the Succulent Karoo, Nama-Karoo and Fynbos biomes (Leistner, 2001; Manning and Goldblatt, 2012; Nordenstam, 2012; Glavich, 2016). The genus is most diverse in semi-arid regions and is largely concentrated in the winter-rainfall parts of Western and Northern Cape Provinces of South Africa and southern Namibia, with a few species occurring in the summer rainfall regions of South Africa (Eastern Cape and Kwa-Zulu Natal) and some extending to Angola and Zimbabwe (Nordenstam, 2007; Manning and Goldblatt, 2012). Species of *Othonna* occur in a variety of habitats from damp sandy flats to dry rocky slopes and granite outcrops (Nordenstam, 1967; Bremer, 1994; Rowley, 1994; Leistner, 2001; Anderberg et al., 2007; Nordenstam, 2009; Manning and Goldblatt, 2012). *Othonna* was established by Linnaeus (1753) to accommodate 14

species, with *O. coronopifolia* L. designated as the type (Hitchcock and Green, 1929). Of those original species, only four are still recognized in *Othonna*, while the others were subsequently transferred to several related and unrelated genera, viz. *Cineraria* L., *Euryops*, *Hertia*, *Ligularia* Cass., *Senecio*, and *Tephroseris* (Rchb.) Rchb. (Nordenstam and Illarionova, 2005).

As currently circumscribed, *Othonna* includes geophytes, subshrubs and succulents with more or less plane leaves, radiate or disciform capitula with male disc florets and female-fertile marginal florets with a creamy-buff pappus (usually 5 to 15 mm long and rarely caducous) that is sometimes accrescent (Magoswana et al., 2016; Appendix 1). The diagnostic generic character for *Othonna* is the female-sterile disc florets with simple (or minutely bifid) styles (Harvey, 1865; Leistner, 2001; Magoswana et al., 2016).

The disciform species of *Othonna* were previously treated in the separate genus *Doria* Thunb. (Thunberg, 1800). This genus originally comprised a dozen species but since the publication of Thunberg's monograph, some 13 additional species have been described. This separate generic circumscription was followed by both Candolle (1838) and Harvey (1865) but modern treatments follow Schultz (1844) in including *Doria* within an expanded *Othonna*. This treatment is supported by recent phylogenetic analyses (Pelser et al. 2007).

The morphological diversity within *Othonna* prompted Harvey (1865) to divide the species among six different groups based largely on habit and branching of the inflorescence (viz., *Caulescentes*, *Carnosae*, *Fruticulosae*, *Paniculatae*, *Scarpigerae* and *Suffruticulosae*). In this classification the majority of the geophytic species (the main focus

of the present study) were treated in the *Caulescentes*, although some were placed within the *Carnosae*, *Paniculatae* and *Scarpigerae*.

There are currently ca. 21 recognised geophytic species of *Othonna*, endemic to the Greater Cape Floristic Region (GCFR) (Manning and Goldblatt, 2012; Snijman, 2013). These species differ from others in the genus by the presence of an underground tuber and often basal or tufted leaves ranging in length from 10–70 cm. Within the geophytic species, Harvey (1865) identified two informal morphological groups; *Scapigerae* distinguished by the rosulate habit with short, condensed caudex, and *Caulescentes* with a tuberous rootstock and well-developed stem with the leaves cauline. The *Caulescentes* group (hereafter termed the '*O. bulbosa*' group) is treated in the present study. All members of the '*O. bulbosa*' group are characterised as deciduous geophytes with annual stems; yellow, purple or pink radiate or disciform capitula on solitary or branched peduncles.

Phylogenetic and biogeographic relationships within *Othonna* have not yet been adequately analysed, although the systematic position of the genus in the tribe has been established (Pelser et al., 2007). Despite relatively few species of *Othonna* being included in this study, these fell into two clades, prompting Nordenstam (2012) to segregate the group of highly succulent, terete-leaved species as the genus *Crassothonna* B. Nord.

The geophytic habit has been recognized as an important adaptive strategy in several Cape lineages, including the Iridaceae (Goldblatt et al., 2002), Geraniaceae (Bakker et al., 2005), Orchidaceae (Linder and Kurzweil, 1999) and Hyacinthaceae (Goldblatt and

Manning, 2000). Although knowledge on the evolution of geophytism has received little attention (Oberlander, 2009), knowledge on the taxonomy and ecology of this habit has progressed over time (Procheş et al., 2006).

The South African species of *Othonna* were last revised by Harvey in 1865.

Consequently many species, particularly in the winter rainfall-region, remain poorly understood, with the exception of the species treated by Rowley (2002). Manning and Goldblatt (2010) re-examined the taxonomic status of a few species whose identity was uncertain. As a start to a complete revision of the genus *Othonna* the present study presents a revision of the geophytic species.

1.1. The explicit aims of this study were to:

1. Generate high quality comparative data on the habit and general morphology of the '*O. bulbosa*' group.
2. Assess the monophyly and phylogenetic relationships of the '*O. bulbosa*' group relative to other species of *Othonna*, through phylogenetic analyses of molecular sequence data.
3. Present a taxonomic revision of the '*O. bulbosa*' group of *Othonna*, including their correct nomenclature, synonymy, typification, diagnostic characters and geographical distributions.

CHAPTER 2

MATERIALS AND METHODS

A revision of the geophytic species of *Othonna* L., the '*O. bulbosa*' group is presented in Chapter 5, in which the nomenclature and revised taxonomic concepts including author citations (according to IPNI, 2017) used throughout this dissertation can be found. For species other than the '*O. bulbosa*' group, the author citations are given at first mention and not repeated elsewhere. The taxonomic citations given in abbreviated form in Chapter 5 (abbreviated as in Stafleu and Cowan, 1976) are not included in the reference list.

2.1 Herbarium material

The complete collections of the geophytic species of *Othonna*, particularly the '*O. bulbosa*' group, from the following herbaria were studied: BOL, NBG (including SAM) and PRE (abbreviations according to Holmgren et al., 1990; Thiers 2016). The recorded distribution of each species in the '*O. bulbosa*' group was ascertained and mapped using this material together with information from Leistner and Morris (1976). Phenology and habitat information were derived from both these sources and field collections. Specimens examined are cited and arranged by Country, Province and district following the Quarter Degree Reference system (Edwards and Leistner, 1971; Leistner and Morris, 1976).

2.2 Field studies

Several geophytic species of *Othonna* were observed in the field and leaf tissue sampled in silica gel for molecular studies. Vouchers were pressed and dried for herbarium specimens and are kept at NBG. Photographs were taken to record habit and certain features of gross morphology.

2.3 Gross morphology

When investigating quantitative characters, floral dissections were performed using a geographically representative sampling of each species (Table 2.1). The capitula were initially rehydrated for an hour in pre-boiled water and subsequently the involucre bracts and florets (ray and disc), anthers and stigmas were excised and studied under an Olympus SZ61 stereomicroscope and photographed using an Olympus SC30 camera with Olympus analysis getIT soft imaging software.

2.4 Data Capturing

To ensure that the full extent of the variation shown by the species was represented, measurements of vegetative and floral structures were taken from specimens across each species' distribution range (Table 2.1). Illustrations and photographs were deep-etched on Adobe Photoshop Elements 2.0.

2.5 DNA extraction, amplification and sequencing

DNA was extracted from silica-dried leaf material (0.2-0.3 g) using the DNEasy plant DNA extraction kit (Qiagen Inc.) following the manufacturer's protocol. Sources of plant material and voucher specimen information of the extracted material used during the study are listed in Table 2.2. All other accessions not extracted in this study but included in the analysis are listed in Table 2.3.

The internal transcribed spacer (ITS) of nuclear ribosomal DNA was amplified by means of Polymerase Chain Reactions (PCR) using the primer combinations of Funk et al. (2004), ITS5A (5'-GGA AGG AGA AGT CGT AAC AAG G-3') and ITS4 (TCC TCC GCT TAT TGA TAT GC-3'), or those of White et al. (1990), AB101 (5'- ACG AAT TCA TGG TCC GGT GAA GTG TT-3') and AB102 (TAG AAT TCC CCG GTT CGC TCG CCG TT-3'). The *rps16* intron was amplified using the primers of Oxelman et al. (1997): *rps16*—1F (5' GTG GTA GAA AGC AAC GTG CGA CTT—3') and *rps16*—2R (5'—TCG GGA TCG AAC CAT CAA TTG CAAC-3'). The *trnL*–*trnF* region (consisting of the adjacent *trnL* intron and *trnL*–*trnF* intergenic spacer) was amplified using the exon primers: *trnL*-c (forward) (5'—CGA AAT CGG TAG ACG CTACG-3') and *trnL*–*trnF* (reverse) (5'—ATT TGA ACT GGT GAC ACG AG-3') (Taberlet et al., 1991).

Amplification reactions were carried out in 25 µl reactions containing: 12.5 µl EmeraldAmp GT PCR Master Mix [2X PCR Master Mix which consisted of DNA polymerase, optimized reaction buffer, dNTPs, density reagent and green dye] (Takara, Ohtsu, Japan); 0.5µl bovine serum albumin (BSA); 0.3 µl of both forward and reverse primers; 0.5 µl of dimethyl sulfoxide (DMSO); 0.5 ul of DNA template and sterile distilled

water to make up the final volume of 25 µl. In an attempt to amplify samples that proved difficult to amplify, dilutions were done on the extracted DNA material ranging from 1:10 to 1:50.

The PCR cycles of the nrDNA were done with the following temperature profile: 2 min at 95 °C, then 35–40 cycles of 30 s at 95 °C, 30 s at 50 °C, 60 (80) s at 72 °C, with a final extension of 8 min at 72 °C. While the PCR cycles of the cpDNA markers were carried out with the following temperature profile: 2 min at 94 °C, then 35–40 cycles of 60 s at 94 °C, 60 s at 53 °C, 60 min at 72 °C, with a final extension for 8 min at 72 °C. Amplified PCR products were visualized using an ENDURO™ GDS Gel Documentation System. Successfully amplified PCR samples were purified using the ExoSAP PCR clean-up method of Werle et al. (1994) using 5 units of Exonuclease I (Exo) and 0.5 units of Shrimp Alkaline Phosphatase (SAP). The cleaned PCR products were sent to MacroGen Inc. (Seoul, Korea) for sequencing using the same primers as were used in the PCR reactions.

2.6 Sequence alignment and phylogenetic analyses

Complementary strands of the sequenced genes were edited and aligned manually in MEGA version 6.06 (Tamura et al. 2013). The maximum parsimony (MP) algorithm was implemented in PAUP* version 4.0b4 (Swofford, 2002). Character transformations were unordered and equally weighted (Fitch, 1971). A heuristic search with 5 000 random sequence additions, tree bisection reconnection (TBR) branch-swapping, and the MULPARS option selected, was performed for all analyses. All character

transformations were treated with equal likelihood and a limit of 10 trees per replicate was set to reduce the time spent on swapping in each replicate. Trees of the shortest length were saved and used as starting trees for a second round of TBR swapping with no limit on the number of trees saved, to ensure the shortest trees were recovered in the analysis.

Internal support was assessed with 1 000 bootstrap replicates (Felsenstein, 1985) using TBR swapping and holding 10 trees per replicate. Only values greater than 50% were retained, and the following scale was used to evaluate support percentages: 50%–74%, weak; 75%–84%, moderate; and 85%–100%, strong.

Bayesian inference (BI) was done using MrBayes v. 3.2.3 (Ronquist and Huelsenbeck, 2003). The analyses were performed on the CIPRES Portal, v. 3.3 (Miller et al., 2010). Substitution models were estimated using the Akaike information criterion (AIC) of jModelTest (Posada, 2008). Data were partitioned accordingly in each dataset and all parameters were unlinked (statfreq, revmat, shape, pinvar) between partitions. For ITS and *rps16* model GTR + I + G was implemented (a model considered the most complex model) (Huelsenbeck and Rannala, 2004) and model SYM+ I + G was implemented for the *trnL-trnF* gene region. The individual ITS and combined ITS/plastid datasets were analysed for 2 000 000 generations while the individual plastid dataset was analysed for 3 000 000 generations. All datasets were analysed with a sample frequency of 1000. The standard deviation of split frequencies stabilised below 0.01, providing evidence that a sufficient number of generations had been completed. Using Tracer v.1.5 (Rambaut and Drummond, 2009), suboptimal trees were discarded as the “burn-in”

phase. Only support values greater than 0.5 were retained, and the following scale was used to evaluate support values: 0.50–0.94, weak; and 0.95–1.0, strong.

To assess congruency of the gene regions amplified for the '*O. bulbosa*' group, the bootstrap consensus trees from the ITS, *rps16* and *trnL-trnF* data sets were compared. These trees were considered incongruent only if they displayed 'hard' (i.e., incongruencies with strong bootstrap values) rather than 'soft' (i.e., incongruencies with weak bootstrap values) incongruence (Seelanan et al. 1997; Wiens 1998). Due to low sequence divergence of the plastid regions, datasets were analysed in combination and these were further combined with the ITS dataset.

Table 2.1. Voucher specimens for species of the '*O. bulbosa*' group used for floral dissections to measure capitula structures.

Taxon	Voucher specimen
<i>O. undulosa</i>	<i>Taylor 4919</i> (NBG)
	<i>Thompson 2472</i> (NBG)
	<i>Hugo 518</i> (NBG)
<i>O. tephrosioides</i>	<i>Zeyher 999</i> (NBG)
	<i>Marloth 1227/37</i> (BOL, NBG)
<i>O. digitata</i>	<i>Dümmer 624</i> (NBG)
	<i>Runnalls 690</i> (NBG)
	<i>Martin 366</i> (NBG)
<i>O. pinnata</i>	<i>Cloete and Cillie 62</i> (NBG)
	<i>Johnson 510</i> (NBG)
	<i>Nicholson and Roets 107</i> (NBG)
<i>O. heterophylla</i>	<i>Kruger 123</i> (NBG)
	<i>Haynes 676</i> (NBG)
	<i>Taylor 5823</i> (NBG)
<i>O. rosea</i>	<i>Harrower 1500</i> (NBG)
	<i>Manning 2923</i> (NBG)
	<i>Compton 20672</i> (NBG)

<i>O. rufibarbis</i>	<i>Fourcade 3277 (BOL, NBG)</i>
	<i>Paterson 2717 (BOL)</i>
<i>O. hederifolia</i>	<i>Pretorius 250 (NBG)</i>
	<i>Maguire 270 (NBG)</i>
<i>O. bulbosa</i>	<i>Rycroft 885 (NBG)</i>
	<i>Taylor 8129 (NBG)</i>
	<i>Burgers 2005 (NBG)</i>
<i>O. macrophylla</i>	<i>Compton 11094 (NBG)</i>
	<i>Henderson 2087 (NBG)</i>
	<i>Compton 5429 (NBG)</i>
<i>O. cakilefolia</i>	<i>Rourke 1422 (NBG)</i>
	<i>Barker 1029 (NBG)</i>
<i>O. rotundiloba</i>	<i>Van Zyl 4403 (NBG)</i>
	<i>Helme 4449 (NBG)</i>
	<i>Hall 3447 (NBG)</i>
<i>O. intermedia</i>	<i>Paterson-Jones 809 (NBG)</i>
	<i>Snijman 1987 (NBG)</i>
	<i>Barker 9061 (NBG)</i>
<i>O. petiolaris</i>	<i>Compton 10983 (NBG)</i>
	<i>Oliver 4953 (NBG)</i>
	<i>Van Zyl 4404 (NBG)</i>
<i>O. lilacina</i>	<i>Hall 575 (NBG)</i>
	<i>Oliver 7710 (NBG)</i>
	<i>Snijman 2008 (NBG)</i>
<i>O. perfoliata</i>	<i>Bruyns 3203 (NBG)</i>
	<i>Pond UP77 (NBG)</i>
	<i>Pretorius 245 (NBG)</i>
<i>O. linearifolia</i>	<i>Barker 4501 (NBG)</i>
	<i>Stummer FOT1103/CR15174 (NBG)</i>
	<i>Boucher and Shepherd 4365 (NBG)</i>
<i>O. oleracea</i>	<i>Ebrahim CR 2625 (NBG)</i>
	<i>Compton 24292 (NBG)</i>
	<i>Low 4660 (NBG)</i>
<i>O. gymnodiscus</i>	<i>Olivier 39 (NBG)</i>
	<i>Compton 19620 (NBG)</i>
	<i>Nicholson and Roets 918 (NBG)</i>
<i>O. cuneata</i>	<i>Compton 11079 (NBG)</i>
	<i>Bruyns 10469 (NBG)</i>
	<i>Hugo 466 (NBG)</i>
<i>O. sinuata</i>	<i>Barker 9726 (NBG)</i>
	<i>Bolus s.n. (NBG)</i>
<i>O. stenophylla</i>	<i>Manning s.n. (NBG)</i>
	<i>Compton 17380 (NBG)</i>

	<i>Compton 15866</i> (NBG)
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Table 2.2. Voucher specimens of material used for DNA extraction and sequencing in this study.

Taxon	Voucher specimen
<i>Othonna retrorsa</i>	<i>Manning and Magoswana 3540</i> (NBG). South Africa, ± 5 km North of Darter's grave.
<i>Othonna arbuscula</i>	<i>JD 4441</i> (NBG). South Africa, Umduus N of Steinkopf.
<i>Othonna taraxacoides</i>	<i>JD 4448</i> (NBG). South Africa, Steinkopf, W of town along highway.
<i>Othonna lobata</i>	<i>KNBG 148/65</i> (NBG). South Africa, Kirstenbosch Botanical Gardens.
<i>Othonna sp. nov.</i>	<i>Manning and Magoswana 3507</i> (NBG). South Africa, ± 1 km along road from Dwars in die weg to Rietkuil.
<i>Othonna daucifolia</i>	<i>KNBG 305/99</i> (NBG). South Africa, Kirstenbosch Botanical Gardens.
<i>Othonna arbuscula</i>	<i>Van Jaarsveld 9681</i> (NBG). South Africa, Gamka, Verberg.
<i>Othonna cacaloides</i>	<i>Manning and Magoswana 3557</i> (NBG). South Africa, Gifberg.
<i>Othonna ramulosa</i>	<i>Manning and Magoswana</i> (NBG). South Africa, Karooport, at turnoff to Sutherland.
<i>Othonna spinescens</i>	<i>Manning and Magoswana 3501</i> (NBG). South Africa, Karooport, at turnoff to Sutherland.
<i>Othonna pteronoides</i>	<i>Manning and Magoswana 3506</i> (NBG). South Africa, ± 1 km along road from Dwars in die weg to Rietkuil.
<i>Othonna digitata</i>	<i>Winter s.n.</i> Cape Agulhus National Park.
<i>Othonna macrophylla</i>	<i>Manning and Magoswana 3544</i> (NBG). South Africa, ± 1 km North of Darter's grave.
<i>Othonna oleracea</i>	<i>Manning and Magoswana 3522</i> (NBG). South Africa, between Klawer and Vanrhynsdorp.

<i>Othonna hederifolia</i>	JD 4596 (NBG). South Africa, top of Van Rhyn's Pass.
<i>Othonna cuneata</i>	<i>Manning and Magoswana 3525</i> (NBG). South Africa, ± 3 km on the Douse the Glim turnoff.
<i>Othonna gymnodiscus</i>	<i>Manning and Magoswana 3513</i> (NBG). South Africa, Elandsberg Nature Reserve, middle road.
<i>Othonna bulbosa</i>	<i>Manning and Magoswana 3532</i> (NBG). South Africa, Bains-kloof Pass.
<i>Othonna stenophylla</i>	<i>Manning and Magoswana 3512</i> (NBG). South Africa, Elandsberg Nature Reserve, middle road.
<i>Othonna linearifolia</i>	<i>Koopman 1274</i> (NBG). South Africa, ERF 946, Chatsworth.
<i>Othonna heterophylla</i>	<i>Manning and Magoswana 3509</i> (NBG). South Africa, Elandsberg Nature Reserve, middle road.
<i>Othonna pinnata</i>	<i>Manning and Magoswana 3510</i> (NBG). South Africa, Elandsberg Nature Reserve, middle road.
<i>Othonna perfoliata</i>	<i>Manning and Magoswana 3529</i> (NBG). South Africa, Worcester.
<i>Othonna quiquidentata</i>	<i>Manning and Magoswana 3503</i> (NBG). South Africa, Dutoitskloof Pass near bottom on Paarl side.
<i>Othonna retrofracta</i>	<i>Manning and Magoswana 3528</i> (NBG). South Africa, Worcester.
<i>Othonna arborescens</i>	<i>Manning and Magoswana 3552</i> (NBG). South Africa, top of Spaktakyl Pass.
<i>Othonna natalensis</i>	<i>Manning 3571</i> (NBG). South Africa, Volkrust, Majuba.
<i>Othonna retrofracta</i>	<i>James Deacon 4463</i> (NBG). South Africa, top of Van Rhyn's Pass.
<i>Hertia ciliata</i>	<i>Manning and Magoswana 3505</i> (NBG). South Africa, Farm Seukop near top of Gannaga Pass, Gannakuilsrivier crossing.
<i>Lopholaena coriifolia</i>	<i>Turnip 1262</i> . Buffelskloof Nature Reserve.
<i>Lopholaena distica</i>	<i>Turnip 1263</i> . Buffelskloof Nature Reserve.
<i>Crassothonna protecta</i>	<i>Manning and Magoswana 3494</i> (NBG). South Africa, Klein Roggeveld, Meintjiesplaas.

<i>Gymnodiscus linearifolius</i>	<i>Manning and Magoswana 3546</i> (NBG). South Africa, ± 10 km from Kamieskroon on road to Skilpad.
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Table 2.3. Voucher specimens of material obtained from Genbank.

Taxon	Voucher specimen	Accession no.		
		<i>ITS</i>	<i>rps16</i>	<i>trnL-trnF</i>
<i>Crassothonna alba</i> (Compton) B. Nord.	<i>Nordenstam and Lundgren 1161</i> (S)	EF538272	-	-
<i>Crassothonna sedifolia</i> (DC.) B. Nord.	<i>Devos ND050905_1</i> (GRA)	EU667492	EU667556	EU670113
<i>Crassothonna carnososa</i> Less.	<i>Devos ND120605_1</i> (GRA)	EU667499	EU667562	EU670120
<i>Gymnodiscus capillaris</i> (L.f.) DC.	<i>Devos ND300805_1</i> (GRA)	EU667515	EU667578	EU670135
<i>Othonna auriculifolia</i> Licht. ex Less.	<i>Nordenstam 719</i> (S)	EF538274	-	-
<i>Othonna euphorbioides</i> Hutch.	<i>Devos ND060905_3</i> (GRA)	EU667494	-	EU670115
<i>Othonna eriocarpa</i> (DC.) Sch. Bip.	<i>Barker NB1938</i> (GRA)	EU667484	EU667548	EU670106
<i>Euryops othonnoides</i> (DC.) B. Nord.	<i>Devos ND010905_1</i> (GRA)	EU667503	EU667566	EU670123
<i>Euryops multifidus</i> (Thunb.) DC.	<i>Devos ND040905_3</i> (GRA)	EU667490	EU667554	EU670112
<i>Euryops galpinii</i> Bolus	<i>Devos ND081005_4</i> (GRA)	EU667496	EU667559	EU670117
<i>Hertia cheirifolia</i> Kuntze	<i>Jeffrey 03</i> (K)	EF538226	-	-
<i>Hertia maroccana</i> (Batt.) Maire	<i>Podlech 50774</i> (Morroco)	EF538228	-	-
<i>Hertia angustifolia</i> Kuntze	<i>Sojak 6863</i> (Iran)	EF538225	-	-
<i>Hertia pallens</i> Kuntze	<i>Koekemoer and Funk 1963</i> (PRE)	EF538229	-	GU818011
<i>Senecio vulgaris</i> L.	GLM73615 (Germany)	KT249851	-	EF538139

CHAPTER 3

VEGETATIVE AND REPRODUCTIVE MORPHOLOGY

3.1 Habit

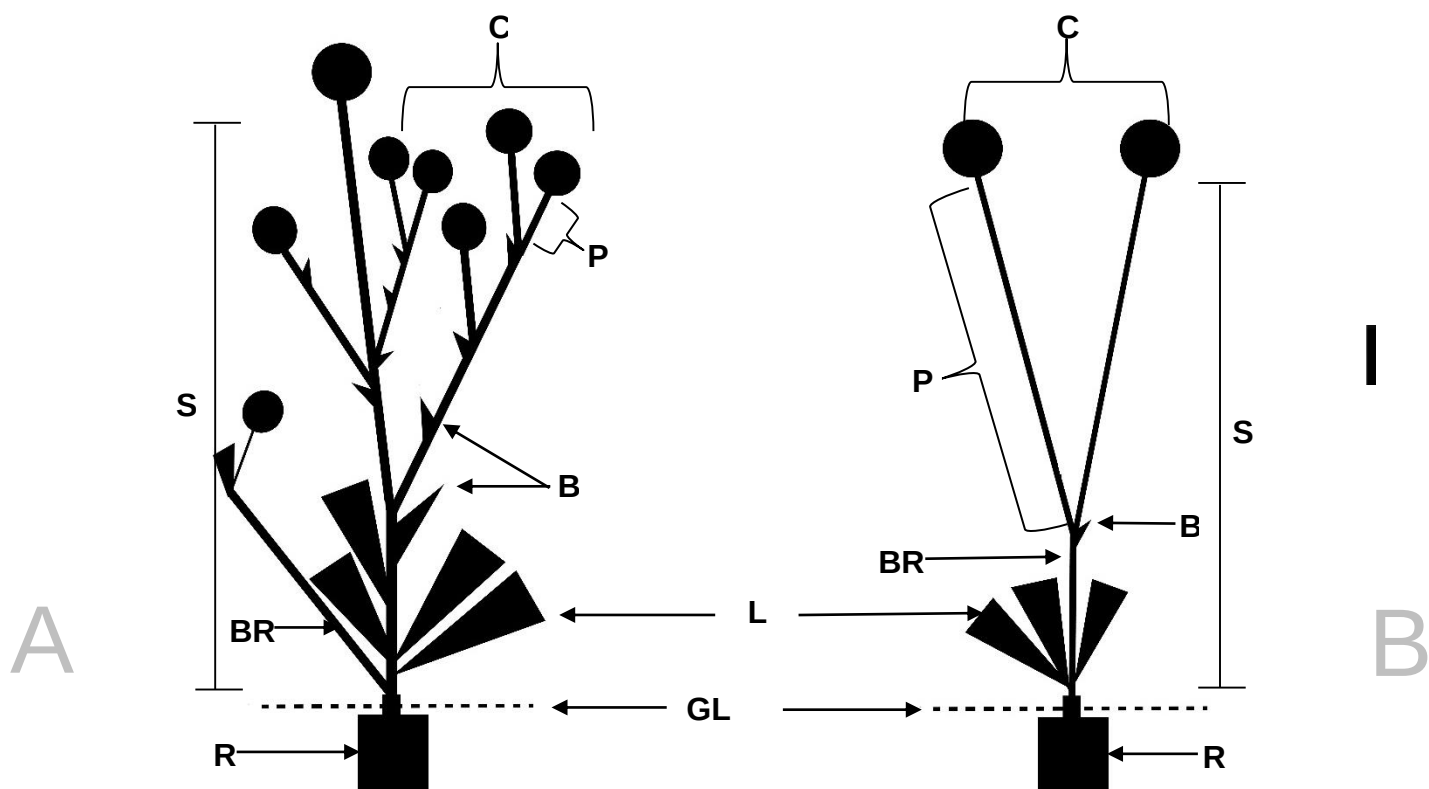
Species of *Othonna* vary in habit from tuberous geophytes and succulent perennial herbs to shrublets or shrubs (Nordenstam, 1967; Bremer, 1994; Rowley, 1994; Anderberg et al., 2007; Nordenstam, 2009). The tuberous geophytes, distinguished by a thickened or swollen tuberous rootstock from which annual shoots arise, can be subdivided into two smaller groups: (1) the '*O. bulbosa*' group (the main focus of the present study) with 23 spp.; and (2) the '*O. auriculifolia*' group with ca. 3 spp. The members of the '*O. bulbosa*' group have the crown or growth point of the subterranean rootstock with its renewal buds buried well below the soil surface, thus with the lower portion of the annual flowering stem underground and the exposed portion well-developed and more or less branched from aerial nodes (Fig. 3.2A-3.2B). The leaves are clearly cauline and emerge from the above-ground portion of the stem except in *O. hederifolia* where the leaves protrude vertically above-ground from slender subterranean petioles (Fig. 3.1B). Leaves are mostly clustered near the base of the aerial portion just above ground level, and the capitula are borne well above ground level on one or more peduncles from the upper nodes of the stem (Fig. 3.2A-3.2B). In contrast, the species of the '*O. auriculifolia*' group have the crown at or near ground level and the annual stem is highly condensed without evident internodes, thus appearing unbranched. The leaves and branches originate directly from the crown of the subterranean tuberous root.

Plants of the '*O. bulbosa*' group are small to medium sized, up to 70 cm tall (Fig. 3.1A–C). The tuberous root is usually turnip-shaped in most species and conical or oblong in a few species, with a characteristically dark brown to black surface, is rough or smooth in texture, and felted at the crown. The rootstock is usually deep-seated, buried more than 10 cm below the surface in most species. The stems are erect or sometimes scandent in a few species (*O. perfoliata* (Fig. 3.1H), *O. rufibarbis* and *O. undulosa* (Fig. 3.1G)) and simple or sparsely branched in the upper half or from near the base. The stems and branches are green or greenish-red. The crown and leaf axils are typically woolly but the remainder of the stem is glabrous except in *O. bulbosa*, *O. digitata*, *O. hederifolia*, and *O. heterophylla*, which are pubescent or woolly in the lower half of the branches.



Figure 3.1. General morphology of the '*O. bulbosa*' group of *Othonna*. A. Habit of *O. bulbosa* showing ovate to oblong or oblanceolate basal leaves and capitula with 12 or 13 ray florets; B. habit of *O. hederifolia* showing the leaves protruding vertically above-ground; C. habit of *O. intermedia* showing the fleshy or somewhat succulent leaves; D.

habit of *O. cuneata* showing fleshy cuneate leaves with variously coarsely toothed apices; E. habit of *O. heterophylla* showing its cuneate to oblanceolate leaves that are puberulous on both surfaces and with undulate-incised or crenate margins; F. large basal leaves of *O. petiolaris* (>30 cm long), and the capitula in lax corymbs, with just 8 or 9 involucre bracts; G. the characteristic scandent habit and sessile, amplexicaul leaves of *O. perfoliata* and the radiate capitula with 8 or 9 involucre bracts; H. habit of *O. undulosa* showing the straggling or scandent stems and disciform capitula; I. the decumbent habit of *O. pinnata*, the pinnatisect or rarely simple or trifid, lanceolate to ovate leaves and solitary capitula. Photographs (A, C–I) taken by J. Manning; (B) taken by N. Helme.



S- Stem; R- Rootstock; GL- Ground level; L- Leaf; B- Bract; BR- Branch; P- Peduncle; C- Capitula

A. Heads one to three (several)

B. Heads one to two (solitary)

Figure 3.2: Schematic diagrams of A. *Othonna tephrosioides*, showing the inflorescence with heads one to three; B. *Othonna oleracea*, showing the inflorescence with solitary to two heads. Vouchers: (A) Zeyher 999 (SAM); (B) Compton 6438 (NBG). Scale: (A & B) 2 cm.

3.2 Foliage

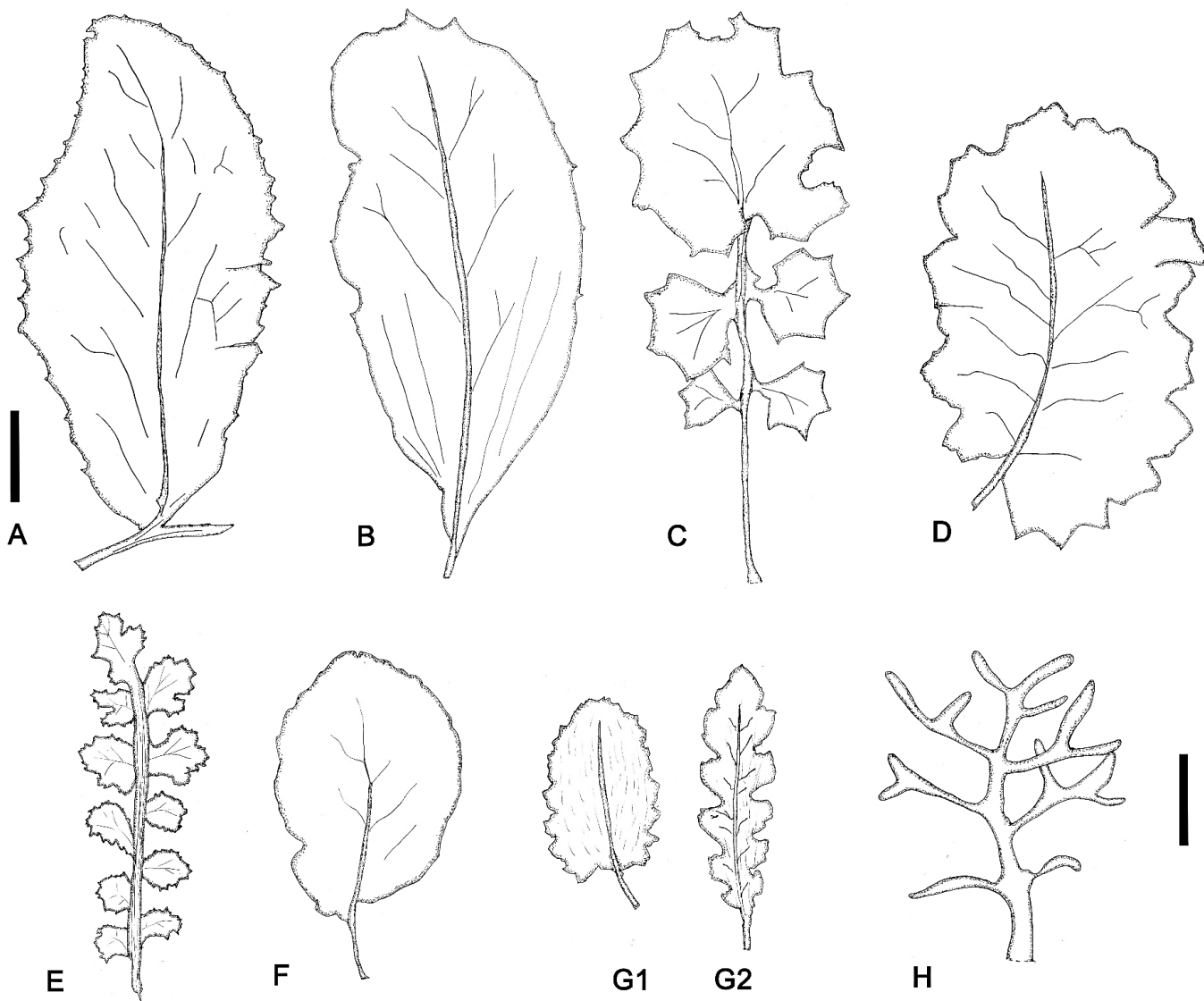
Leaves of the geophytic species of *Othonna* are alternately arranged on the aerial stem, often congested basally (Fig. 3.1A–I). The size, shape and degree of incision of the foliage are important diagnostic characters throughout the genus (Fig. 3.3A–O). The leaves are mostly fleshy or somewhat succulent (viz. *O. intermedia* and *O. cuneata*) (Fig. 3.1C and D), leathery or herbaceous. The lowermost leaves are largest and sometimes more or less basally crowded, usually sessile but sometimes narrowed into a petiole-like base or rarely conspicuously petiolate. In *Othonna hederifolia* the petioles are often subterranean, and consequently pale yellow in colour, both fresh and when dry.

The upper leaves are progressively smaller and invariably sessile, usually less incised than the lower, while the uppermost are smaller and bract-like (Fig. 3.2A–2B). The lowermost leaves are usually erect to spreading or sometimes decumbent in plants of *Othonna pinnata* growing in exposed conditions (Fig. 3.1I). The basal leaves vary in size from less than 20 mm long in some individuals of *O. bulbosa*, *O. hederifolia* and *O. pinnata* to more than 300 mm long in *O. macrophylla*, *O. petiolaris* and *O. rosea* — one basal leaf of large individuals of *O. macrophylla*, *O. petiolaris*, and *O. rosea* can fill an entire herbarium sheet (Fig. 3.1F and Fig. 3.3A–B and D).

The shape and division of the blades of the lowermost leaves is variable among species, either simple and entire or variously dentate to sinuate, lacerate or lobed, trifid or pinnatisect. Most species have simple leaves with entire or variously incised or lobed margins, but in *O. cakilefolia*, *O. digitata*, *O. petiolaris*, *O. pinnata*, *O. rosea* and *O.*

rotundiloba the lowermost leaves are typically or invariably trifid or pinnatifid to pinnatisect.

There is considerable variation within some species or even individuals. An example of this is the distinction between two pink rayed taxa, *Othonna incisa* and *O. rosea*, which were distinguished essentially by the shape and division of the leaves, based on limited material studied (Harvey, 1865). The availability of additional collections revealed that they represent extreme forms of a single species (Manning and Goldblatt, 2010). Leaf variation in the ovate- to lanceolate-leaved species, *O. bulbosa* (Fig. 3.1A and Fig. 3.2N1–N2), and the narrowly lanceolate- to obovate-leaved species, *O. gymnodiscus* (Fig. 3.3K), has in the past led authors such as Candolle (1838) to recognise several taxa as separate species, but in light of more herbarium specimens available for study and field examinations only the two species should be recognised. Leaves of most species are glabrous but those of *O. heterophylla* (Fig. 3.1E) are invariably pubescent while in *O. bulbosa* they are sometimes pubescent towards the base and pubescent along the midvein in *O. sinuata*.



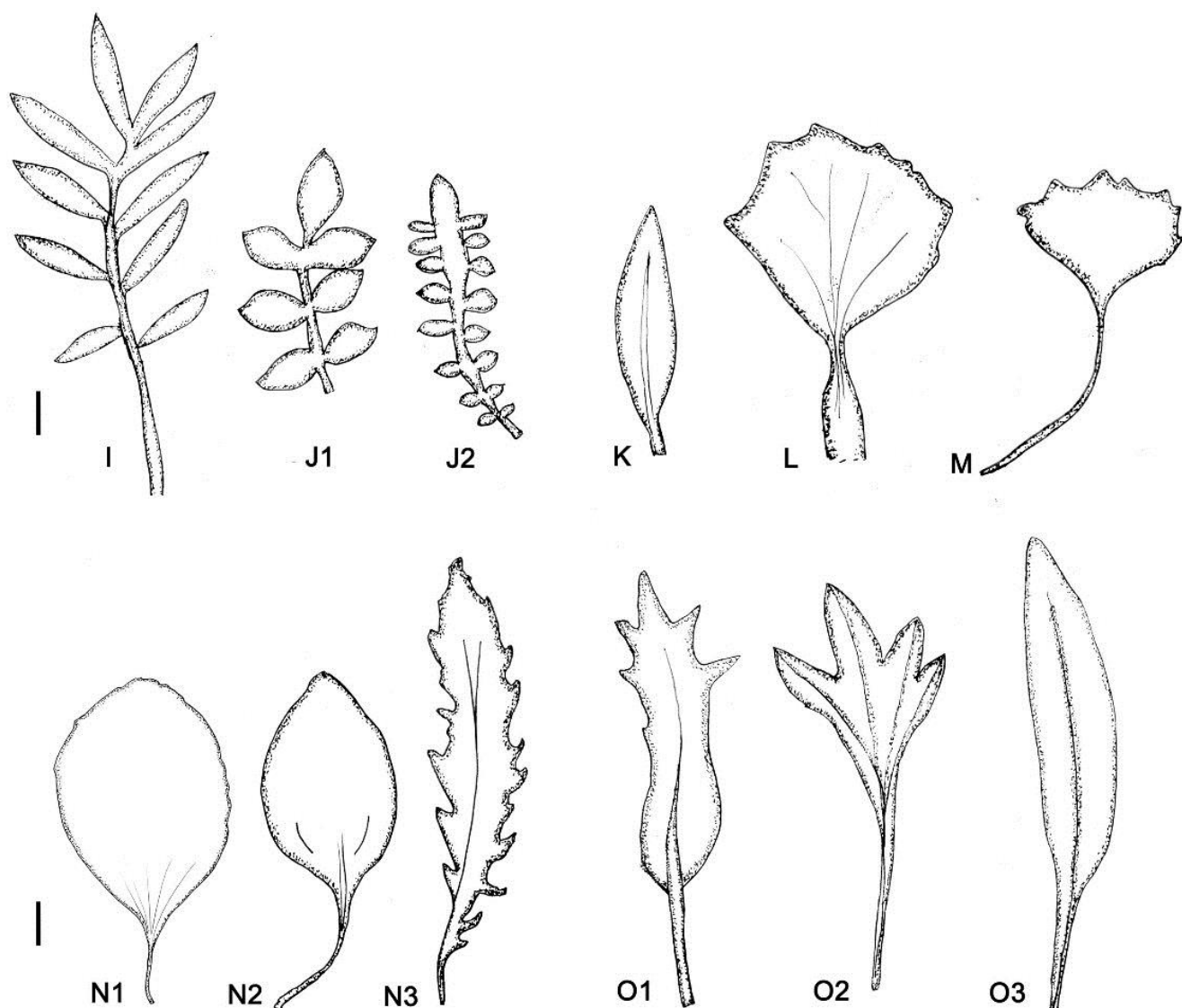


Figure 3.3. Variation in leaf shape of selected species of the '*O. bulbosa*' group. A. The sparsely denticulate to dentate or sharply pinnatifid margined leaves of *O. macrophylla*; B. The large leaves (up to 30 cm long) of *O. rosea* with sparsely denticulate to dentate or sharply pinnatifid margins; C. The lyrate leaves of *O. lyrata*; D. The lacerate leaves of *O. petiolaris*; E. Margins deeply pinnatisect with quadrate lobes that are equally spaced along the axis of *O. rotundiloba*; F. The obovate leaves of *O. oleracea*; G1–G2. The cuneate to oblanceolate leaves that are puberulous on both surfaces and with undulate-

incised or crenate margins of *O. heterophylla*; H. Trifid to pinnatisect leaves with narrow, obtuse lobes of *O. cakilefolia*; I. The pinnatisect or rarely simple or trifid, lanceolate to ovate leaves of *O. tephrosioides*; J1 and J2. *O. pinnata* resembles *O. tephrosioides* in its pinnatisect or rarely simple or trifid, lanceolate to ovate leaves; K. The oblanceolate to elliptic leaves of *O. gymnodiscus*; L. The cuneate leaves with the apices variously coarsely toothed of *O. cuneata*; M. The cuneate leaves of *O. hederifolia* with coarsely toothed apices arising from slender subterrenan petioles; N1–N3. The oblanceolate, sometimes trilobed or pinnatifid but with entire margins leaves of *O. bulbosa*; O1–O3. The digitate or pinnatifid or rarely simple leaves of *O. digitata*. Vouchers: (A) *Compton 11094* (NBG); (B) *Compton 20672* (NBG); (C) *Jakoet and Magee 50* (NBG); (D) *Compton 10983* (NBG); (E) *Van Zyl 4403* (NBG); (F) *Ebrahim CR2625* (NBG); (G1) *Hugo 2659* (NBG); (G2) *Taylor 5823* (NBG); (H) *Rourke 1422* (NBG); (I) *Zeyher 999* (SAM); (J1-J2) *Nicholson and Roets 107* (NBG); (K) *Compton 19620* (NBG); (L) *Hall s.n.* (NBG); (M) *Pretorius 250* (NBG); (N1) *Taylor 8129* (NBG); (N2) *Burgers 2005* (NBG); (N3) *Rycroft 885* (NBG); (O1-O2) *Dümmer 624* (NBG); (O3) *Steyn 194* (NBG). Scales: (A-F, H) 2 cm; (G1 & G2-O3) 1 cm.

3.3 Inflorescence structure

The capitula are solitary or few to several and terminal. They are borne on brittle peduncles with the upper cauline leaves reduced and bract-like. Peduncle length ranges from as short as 10 mm long in *O. cakilefolia*, *O. petiolaris* and *O. tephrosioides* to as long as 390 mm long in *O. sinuata* (Fig. 3.2A-3.2B). Peduncles are usually green in

colour and tend to be mottled purple or at least near the inflorescence (Fig 3.1D). The capitula are either radiate, with ligulate peripheral, or ray florets (Fig. 3.1A–G and I), or disciform, with filiform, female-fertile marginal florets (Fig. 3.1H). Most of the geophytic species are radiate, with the exception of *O. digitata*, *O. gymnodiscus*, *O. linearifolia* and *O. undulosa*, which are disciform.

3.4 Involucres

The individual involucres are campanulate in all species, and vary in size from as little as 5-10 mm diam. in *Othonna stenophylla* to ± 20 mm diam. in several species but up to 30 mm diam. in *O. undulosa*. The involucre bracts are uniseriate, fleshy, and basally shortly connate. They are green with darker apices, and completely glabrous with scarious margins, and are similar in shape in all species in the group, lanceolate or oblanceolate to elliptic.

The number of involucre bracts is critical in distinguishing species, which fall into two groups, those with (7) 8 to 10 involucre bracts and those with 10 to 14 bracts. Candolle (1838) was the first to identify the importance of this character in delimiting taxa and it was subsequently used by Harvey (1865) and later authors. The number of involucre bracts is usually consistent with the number of ray or marginal florets. Thus the two large-leaved and yellow flowered species *O. macrophylla* and *O. petiolaris* were frequently confused with one another but are readily distinguished by the number of involucre bracts among other characters, the Namaqualand species *O. macrophylla* with 12 or 13 bracts and *O. petiolaris* with 8 or 9 bracts. Other species are similarly

consistent in the number of involucral bracts with the sole exception of *O. pinnata*, in which the number of bracts was found to vary from 8 to 13.

3.5 Florets

As in the rest of the genus, the majority of species in the *O. bulbosa* group are radiate (19 spp.) with just four disciform species (*O. digitata*, *O. gymnodiscus*, *O. linearifolia* and *O. undulosa*). The disciform species were segregated as the genus *Doria* (Thunberg, 1800) but Candolle (1838) suggested that these species might be more appropriately treated as a section within *Othonna*. This suggestion was subsequently implemented by Schultz (1844), who transferred the species of *Doria* to *Othonna*, where they have remained since then.

The capitula in all species are heterogamous, with female-fertile ray or marginal florets, and male-fertile disc florets. Marginal ray florets have a three-toothed limb (Fig. 3.4A) which is usually pale to bright yellow in colour, sometimes flushed maroon beneath, but entirely pink to magenta in three species (*O. cakilefolia*, *O. lilacina* and *O. rosea*). The deflexed-spreading limb varies in shape from oblanceolate to oblong. In the disciform species, the limb of the marginal florets is suppressed and the corolla is abruptly truncate and narrowly cylindrical (Fig. 3.4C). The limbs vary in length from 2 mm long in *O. linearifolia* to 6 mm long in *O. undulosa*. The perianth tube is conical in all species, and ranges in length from 1 to 6 mm. The style is branched, with a slightly thickened base. The apices of the style branches are narrowly obovate and shortly papillate, and they have discrete lateral stigmatic areas.

The disc florets are functionally male and concolorous with the rays, with a funnel-shaped tube and five ovate lobes. The tube is usually the same length as the limb, which is campanulate in all species, with lanceolate to ovate, apically spreading lobes. Anthers are uniform throughout the group and the genus *Othonna* as a whole, ranging in length from 1 to 3 mm. They are obtuse at the base with ovate apical appendages, and the filament collar is balusteriform. The disc floret styles are simple or minutely bifid in all species, a diagnostic generic character for *Othonna*.

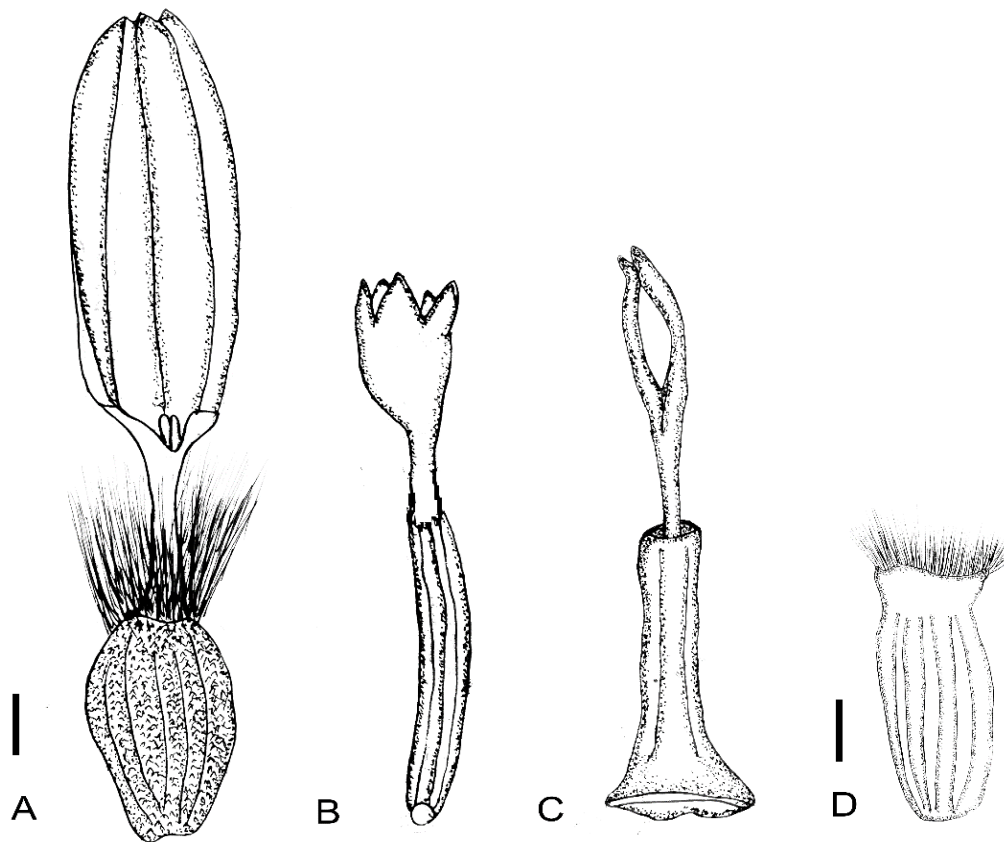


Figure 3.4: Variation in reproductive morphology of the '*O. bulbosa*' group of *Othonna*.

A. Radiate floret of radiate species; B. Disc floret of *O. gymnodiscus* lacking a pappus; C. Filiform, female-fertile marginal floret of disciform species; D. Glabrous cypsela of *O.*

digitata. Vouchers: (A) *Taylor 5823* (NBG); (B) *Compton 19620* (NBG); (C) *Nicholson and Roets 918* (NBG); (D) *Dümmer 624* (NBG). Scales: (A & D) 1 cm; (B-C) 2 cm.

3.6 Pappus morphology

The presence of a pappus is characteristic of the family Asteraceae (Funk et al., 2009). It is generally interpreted as a reduced or modified calyx (Jana and Mukherjee, 2014), that acts as a parachute or barbs that aid in seed dispersal (Rowley, 1990; Mukherjee and Sarkar, 2001; Jana and Mukherjee, 2014). It may also help protect the ovaries from predation (Stuessy and Garver, 1996). The pappus, which is apically inserted on the cypselas, is either caducous or accrescent, and comprises a crown of five or more elements, usually without any vascular tissue (Jana and Mukherjee, 2014).

The pappus in *Othonna* comprises numerous, slender, barbed bristles. Among the species of the *O. bulbosa* group, the ray pappus can be as long as 20 mm in *O. undulosa* and *O. rufibarbis* but usually ranges from 5 to 10 mm long in the other species. The disciform species *O. gymnodiscus* is anomalous in lacking a pappus in the disc florets (Fig. 3.4B). The dwarf succulent species *Othonna cacalioides* L.f. and its allies are anomalous in having ray florets with a very short pappus, and disc florets with the pappus sometimes reduced to one or two small, caducous bristles (Magoswana et al., 2016).

The pappus in *Euryops* (Cass.) Cass., *Gymnodiscus* Less. and other genera of Othonninae is consistently snow white (rarely yellowish-brown) (Nordenstam 1967;

Magoswana et al., 2016) whereas the pappus of the ligulate peripheral, or ray florets of *Othonna* (including the '*O. bulbosa*' group) is invariably creamy-buff in all species, sometimes strikingly banded with maroon or brown at maturity in some species, including *O. digitata*, *O. perfoliata* and *O. rufibarbis*. It is uniformly white or colourless in the disc florets of all species. The pappus in most species elongates only slightly during ripening but in *O. undulosa* and *O. rufibarbis* (and other disciform species in the genus) the bristles elongate to twice the length of the cypselas and resemble a shaving brush.

3.7 Fruit morphology

The cypselas are relatively uniform in shape and vestiture across the group. The cypselas are usually oblong to obovoid, with eight or 10 ribs. They are appressed-puberulous on the ribs with myxogenic or non-myxogenic, white, twin-hairs in most species (Fig. 3.4A), but are glabrous (Fig. 3.4D) in the two disciform species *O. digitata* and *O. linearifolia*. Cypselas in the group range in size from 2–8 mm long but size is not a valuable character to distinguish species within the group as there is often overlap among species.

The myxogenic hairs become mucilaginous in water, and produce long threads of mucus that form a thick slimy cover around the cypselas (Makouate et al., 2012). Myxospermy has proven to be an important survival mechanism for plants from arid regions and restrict dispersal by means of anchorage (Makouate et al., 2012). This phenomenon, however, still requires further investigation.

CHAPTER 4

PHYLOGENETIC RELATIONSHIPS

4.1 Introduction

No satisfactory natural subtribal classification of the taxonomically complex and almost cosmopolitan tribe Senecioneae yet exists. This is primarily due to contradictions in morphological characters, the large size of the tribe, and the absence of a good circumscription of the central genus *Senecio* (Pelser et al., 2007, 2010). The inability to achieve a monophyletic delimitation of the genus *Senecio* has impeded a natural classification of the Senecioneae as a whole (Pelser et al., 2007, 2010; Milton, 2009). There have been several proposed classifications of the tribe (Candolle, 1838; Harvey, 1865; Bentham, 1873; Nordenstam, 1977, 2007; Kadereit and Jeffrey, 1996; Bremer, 1994), and the number of subtribes, their composition and their delimitations have changed regularly over time. Bremer (1994), using a cladistics analysis of morphological characters recognised the three subtribes Blennospermatinae, Senecioninae and Tussilagininae, including Othonninae in a more widely circumscribed Senecioninae. The molecular phylogenetic investigations of Kadereit and Jeffrey (1996) questioned the monophyly of subtribes Senecioninae and Tussilagininae, while studies of Knox and Palmer (1995) suggested that the subtribe Senecioninae may be paraphyletic. Bremer (1994) placed *Othonna* and the South American genus *Werneria* Kunth. as early diverging lineages in the Senecioneae, linked by their connate involucre bracts. However, the involucre bracts in *Othonna* are accurately characterised as free.

Although the clade was said to correspond to Othonninae as previously recognised by some authors, Bremer (1994) found no other characters supporting a relationship between *Othonna* and *Werneria*, and abstained from re-establishing the Othonninae with the assumption that it would lead to an unresolved diagnosis of the subtribe, retaining the two genera in the Senecioninae.

Pelser et al. (2007, 2010) attempted to reconstruct a comprehensive phylogeny for the Senecioneae, and recognised subtribes Abrotanellinae, Othonninae and Senecioninae as monophyletic. The number of molecular studies that have incorporated *Othonna* in assessing relationships are inadequate for any conclusions to be drawn on the monophyly of the genus, and most of these have included a small percentage of the species. In the phylogenetic analysis by Pelser et al. (2007), using nuclear ribosomal DNA internal transcribed spacer (ITS) sequences, seven species of *Othonna* including one tuberous geophyte (*O. auriculifolia*) belonging to the '*O. auriculifolia*' group were included, and the genus was found to be diphylectic, with the core sister (BP 100, PP 1.0) to a clade comprising *Lopholaena* and *Hertia*. Devos et al. (2010) sequenced six species of *Othonna* using the chloroplast DNA regions (*rps16*, *trnT-trnL*, *trnL-trnF*) and the nrITS region and also retrieved *Othonna* as polyphyletic and divided into two separate clades ('*Othonna* clade 1' and '*Othonna* clade 2') corresponding to those of Pelser et al. (2007). '*Othonna* clade 1' was found to be sister to *Hertia*, while '*Othonna* clade 2', comprising succulent, terete-leaved shrublets, was retrieved as sister to *Gymnodiscus*, and was subsequently segregated as the genus *Crassothonna* (Nordenstam, 2012).

None of the tuberous geophytes treated in the present study (as the '*O. bulbosa*' group) were included in any of these analyses, none of which focussed on *Othonna*. The present study is aimed at assessing the monophyly and phylogenetic relationships of the '*O. bulbosa*' group relative to other species of *Othonna*. The phylogenetic sampling of *Othonna* is expanded to include 26 species of the genus, nine representing the '*O. bulbosa*' group.

4.2 Results

4.2.1 Taxon sampling—Sampling of *Othonna* was expanded to include 26 species of the genus, nine representing the '*O. bulbosa*' group. *Senecio vulgaris* was selected as outgroup.

4.2.2 ITS data set— The ITS matrix consisted of a total of 719 unambiguously aligned positions resulting in 155 variable and 114 parsimony informative characters. Maximum Parsimony (MP) analysis retained 3291 trees with a tree length of 497 steps [consistency index (CI)=0.68; retention index (RI)=0.78] (Table 4.1). MP strict consensus tree is similar to that of the Bayesian Inference (BI) majority rule consensus tree (Figs. 4.1 and 4.2). The genus *Othonna* (excl. *Crassothonna*) was strongly supported (BP 100, PP 1.0) as monophyletic and sister to a clade comprising a paraphyletic *Hertia* that includes *Lopholaena*. The recently segregated genus *Crassothonna* was confirmed to be monophyletic (BP 100, PP 0.88) and sister to *Gymnodiscus* (BP 100, PP 0.99).

Although resolution within *Othonna* was poor, two main clades were recovered, one including *O. arbuscula*, and the other with *O. bulbosa*. The latter clade corresponds closely to the geophytic species, recognised here as the '*O. bulbosa*' group (BP 100, PP 1.0). The '*O. bulbosa*' group was strongly supported as monophyletic in both the MP and BI trees (BP 100, PP 1.0). In contrast, the geophytic species from the '*O. auriculifolia*' group were not recovered with the other geophytes in the '*O. bulbosa*' group but rather within the *O. arbuscula* clade, which comprises largely shrubby species. The two species belonging to the '*O. auriculifolia*' group (*O. auriculifolia* and *O. taraxacoides*), which are considered to be closely related based on morphology, were not recovered as sister taxa and thus not recovered as monophyletic.

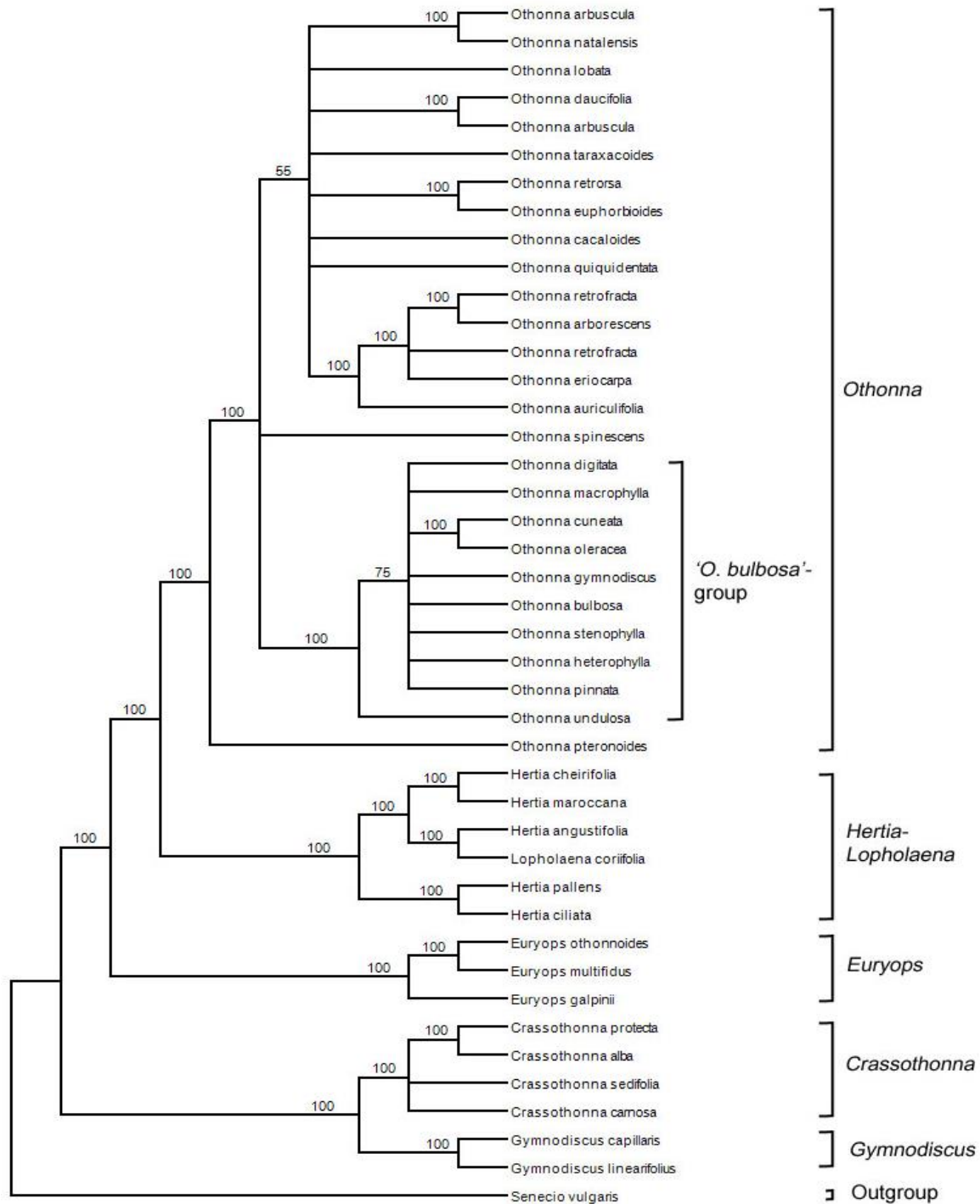


Figure 4.1: Maximum Parsimony tree showing relationships within the Othonninae implied by the strict consensus tree resulting from the analysis of the nrITS data.

Bootstrap support above 50% placed above branches.

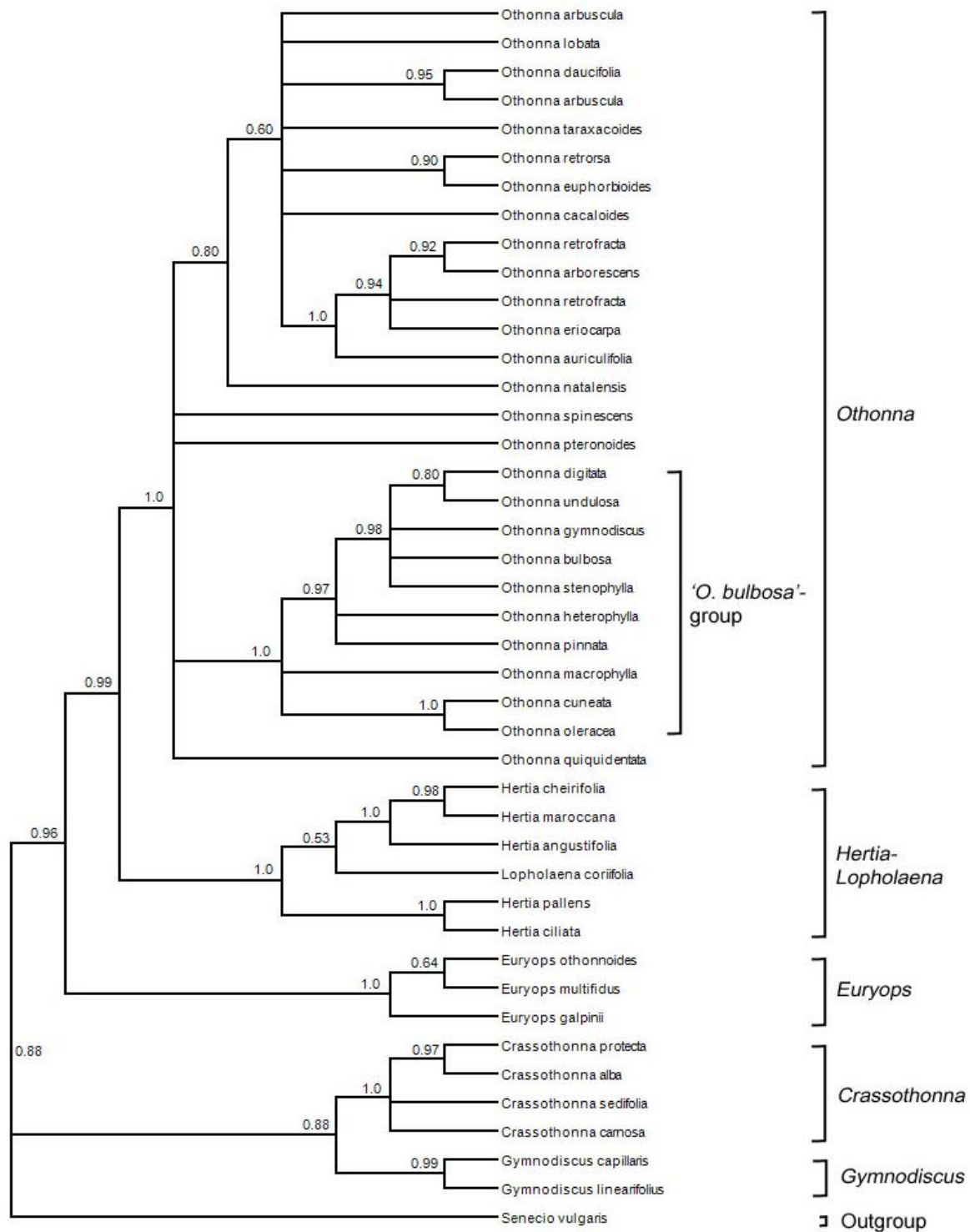


Figure 4.2: Relationships within the Othonninae implied by the bayesian majority rule consensus tree resulting from analysis of the nrITS data with posterior probability values above the branches.

4.2.3 Combined plastid data set—The combined chloroplast matrix consisted of 1691 unambiguously aligned positions resulting in 136 variable and 106 parsimony informative characters. In the MP analysis, 3696 trees were retained with a length of 314 steps (CI= 0.78; RI= 0.84) (Table 4.1). The topology of the BI majority rule consensus tree and that of the MP strict consensus tree are largely congruent (Figs. 4.3 and 4.4). The combined chloroplast trees are less resolved than those of the ITS analyses (Figs. 4.1 and 4.2) and there are some differences in the topologies. *Othonna* (with the notable exception of *O. undulosa*) was only weakly to moderately strongly recovered as monophyletic (BP 100, PP 0.88). No apparent groupings as was recovered in the ITS analyses were recovered within *Othonna*. *Othonna undulosa* was recovered within *Hertia* with strong support (BP 75, PP 0.98). *Crassothonna* was again confirmed to be distinct from *Othonna* (BP 91, PP 1.0) and sister to *Gymnodiscus*. Species belonging to the '*O. bulbosa*' group were not recovered as monophyletic. This was the same for taxa belonging to the '*O. auriculifolia*' group as they too were not recovered as sister taxa.

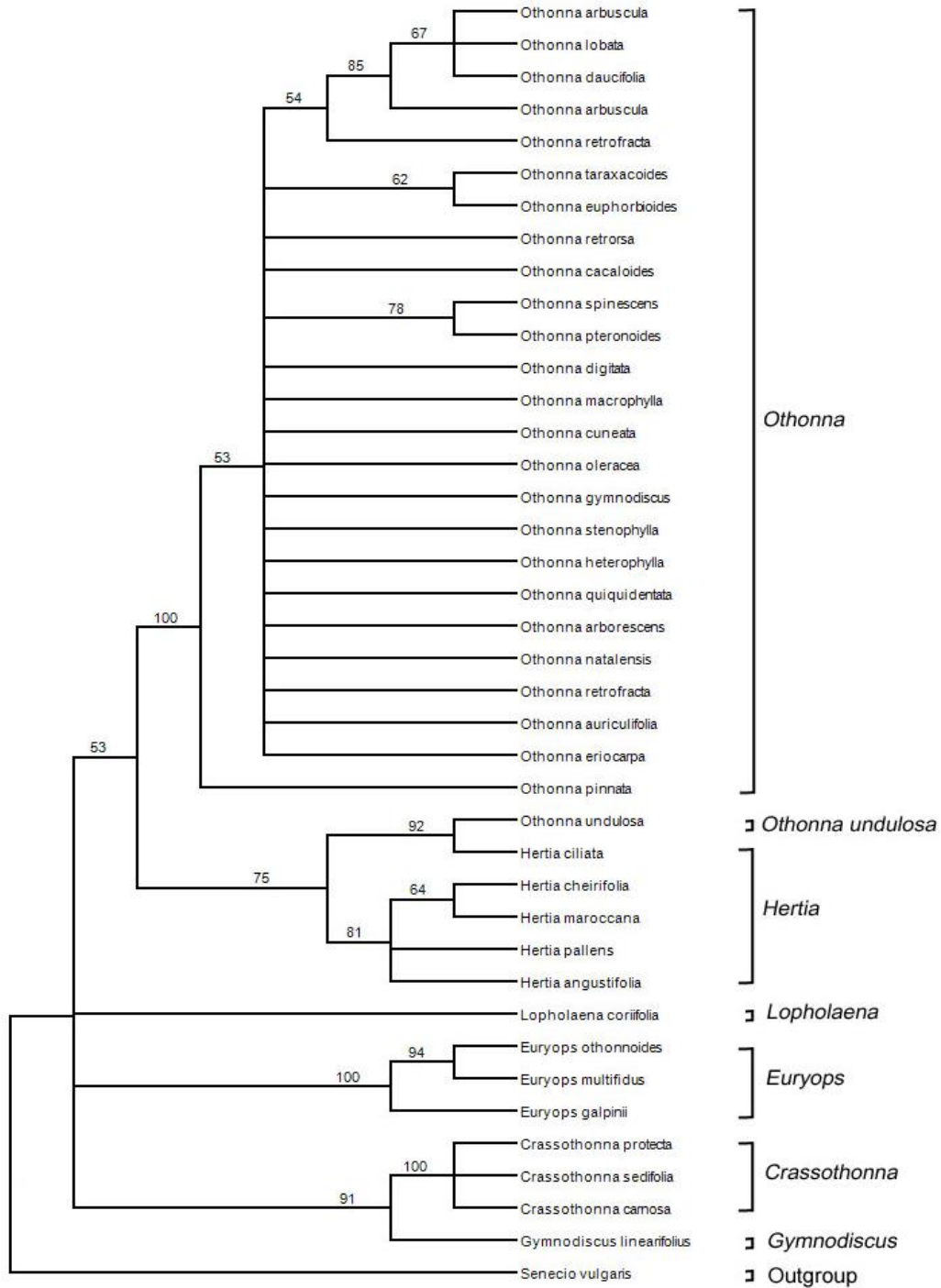


Figure 4.3: Maximum Parsimony tree showing relationships within the Othonninae implied by the strict consensus tree resulting from the analysis of the combined plastid data (*rps16* and *trnL-trnF*). Bootstrap support above 50% placed above branches.

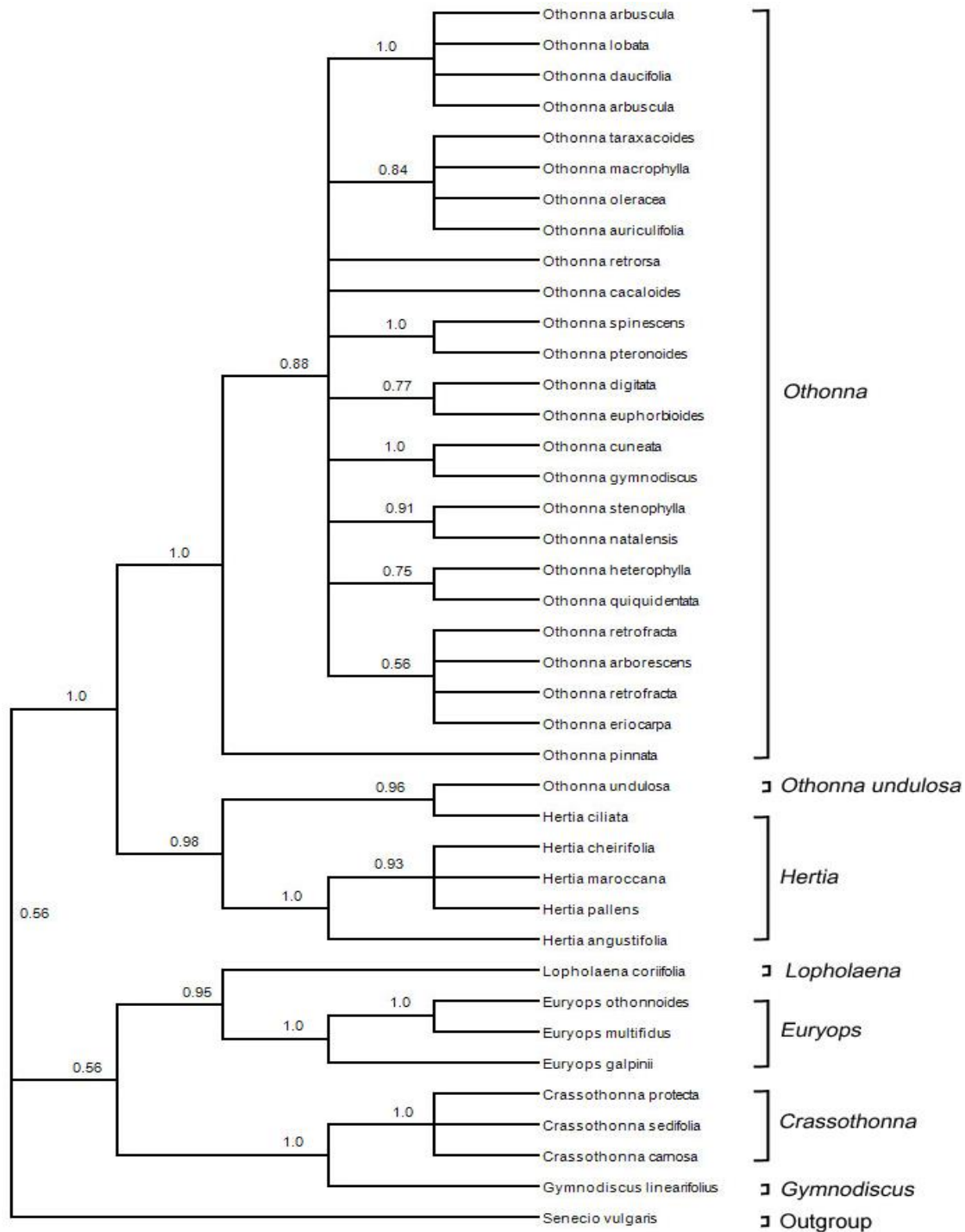


Figure 4.4: Relationships within the Othonninae implied by the bayesian majority rule consensus tree resulting from analysis of the combined plastid data (*rps16* and *trnL-trnF*) with posterior probability values above the branches.

4.2.4 Combined ITS/plastid data set— Visual comparison of the trees from the separate nuclear and plastid datasets uncovered incongruence between the two datasets. The apparent hard incongruence between the datasets was the position of *O. undulosa*, recovered either within *Othonna* (strongly supported in the nuclear analyses; BP 75, PP 0.80) or within the sister genus *Hertia* (strongly supported in the plastid analyses; BP 92, PP 0.96). The genera *Euryops*, *Hertia* and *Lopholaena* also revealed incongruence in the analyses. All the incongruence resulting from the inclusion of these genera was excluded from the analyses and the recovered topology compared to the topologies including each of the incongruencies. To detect the potential cause of incongruence, the entire sequences of the genera *Euryops*, *Hertia* and *Lopholaena* were removed but these exclusions had no effect on the topology of the trees except when *O. undulosa* was present in the analyses. The inclusion of *O. undulosa*, a geophytic species with scandent stems and disciform capitula currently considered as belonging to the '*O. bulbosa*' group, in the analysis yielded weak overall support for *Othonna*. In addition, inclusion of *O. undulosa* in the analysis resulted in a paraphyletic '*O. bulbosa*' group, with taxa from the group embedded within other groups of the genus. Support for a distinct '*O. bulbosa*' group was found to be higher when *O. undulosa* was excluded from the analyses. For these reasons, this species was accordingly excluded from the combined analyses.

The combined ITS and plastid matrix for 42 taxa consisted of a total of 2410 aligned positions resulting in 266 variable and 265 parsimony informative characters. The MP analysis resulted in 27 405 trees, with a tree length of 857 steps CI of 0.73 and RI of

0.77 (Table 4.1). Trees obtained from both the MP and BI analyses resulted in largely congruent overall topologies (Figs. 4.5 and 4.6).

Othonna was strongly recovered as monophyletic (BP 100, PP 1.0) and sister to a clade comprising *Hertia* and *Lopholaena*, with *Euryops* successively sister. *Hertia* was recovered as paraphyletic with the inclusion of *Lopholaena coriifolia* in the MP strict consensus tree. *Lopholaena* was found embedded in a paraphyletic clade with *Hertia* and sister to *Euryops*. As in the nuclear and chloroplast analyses, *Crassothonna* was recovered as distinct and sister to the annual genus *Gymnodiscus* (BP 91, PP 1.0). Within *Othonna* the '*O. bulbosa*' group was strongly supported in the BI tree (PP 1.0) but poorly supported in the MP tree (BP 53). Species belonging to the '*O. bulbosa*' group were divided into four morphologically diagnosable groups based on habit, capitula type and ray colour. However, recovered phylogenetic groupings did not correspond to these morphological groupings. As in the separate ITS and plastid analyses, the two species of the '*O. auriculifolia*' group were again not recovered as sister taxa and consequently not recovered as monophyletic.

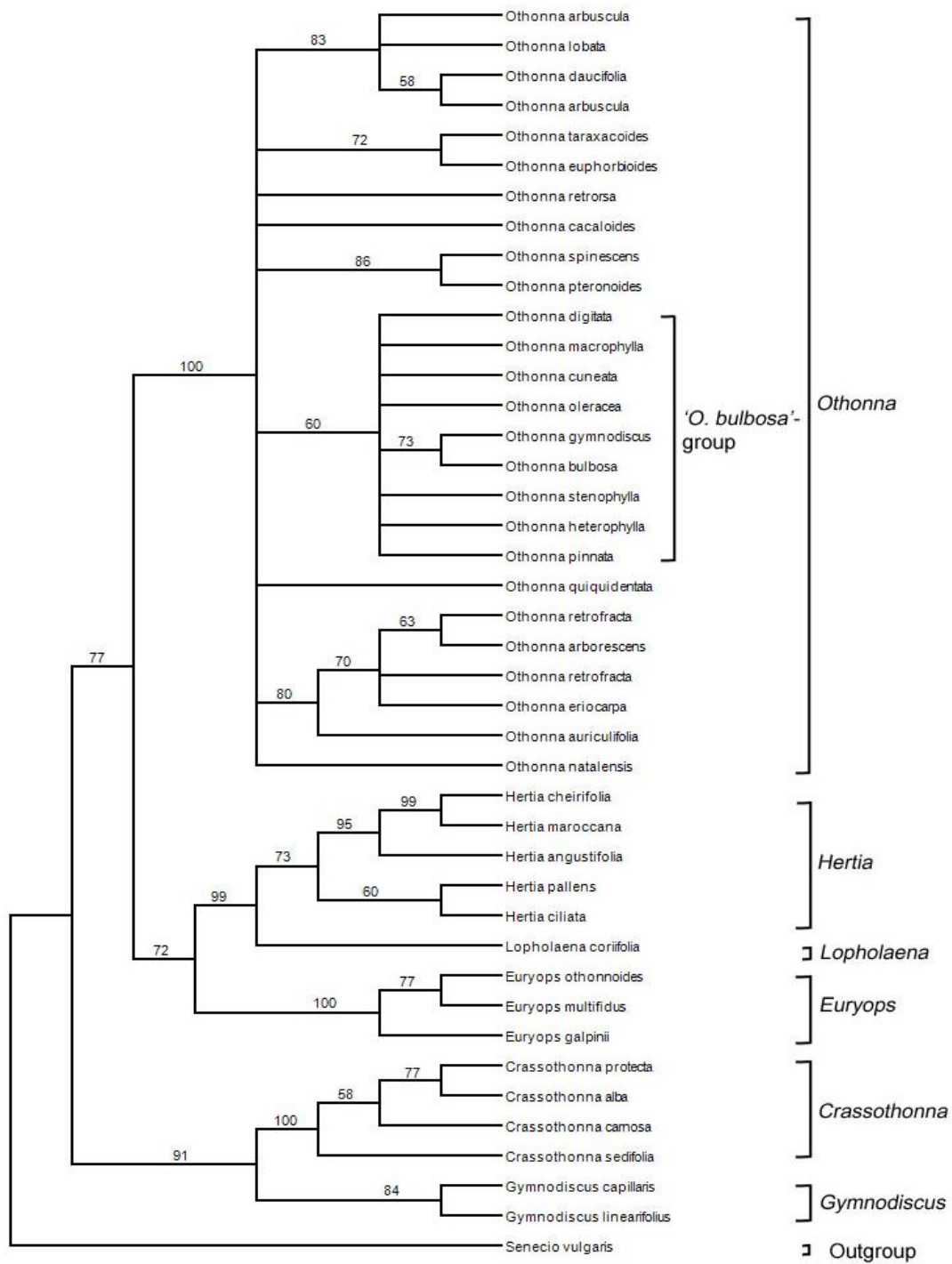


Figure 4.5: Maximum Parsimony tree showing relationships within the Othonninae implied by the strict consensus tree resulting from the analysis of the combined nrITS/plastid data. Bootstrap support above 50% placed above the branches.

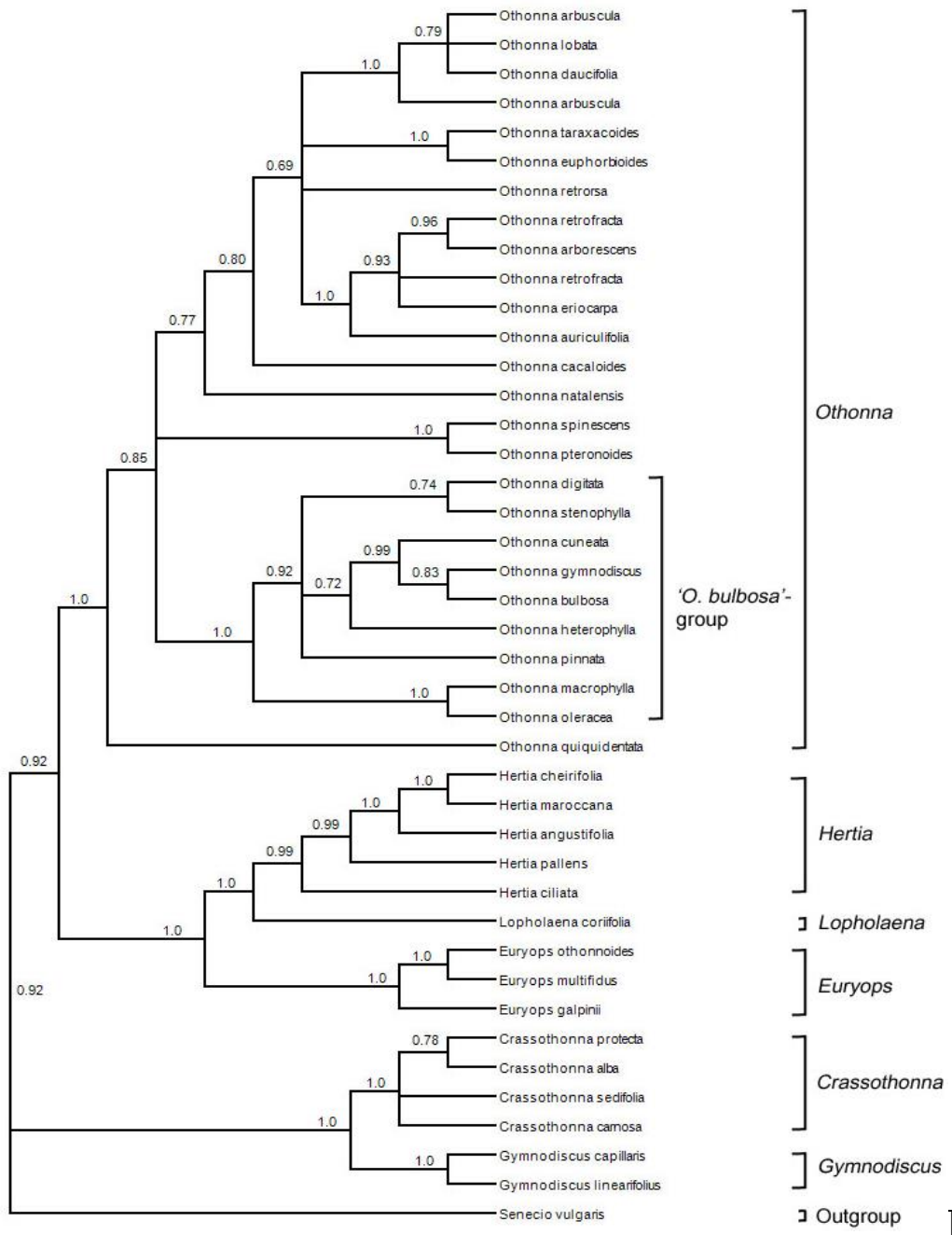


Figure 4.6: Relationships within the Othonninae implied by the bayesian majority rule consensus tree resulting from analysis of the of the combined nrITS/plastid data with posterior probability values above the branches.

Table 4.1 Statistics and sequence characteristics of the regions, ITS, *rps16*, *trnL-trnF* and combined analyses.

DNA region	ITS	Plastid (<i>rps16</i> & <i>trnL-trnF</i>)	Combined
No. of taxa	43	40	42
No. of included positions in a matrix	719	1691	2410
No. of constant characters	450	1449	1879
No. of parsimony informative characters	114 (15.9%)	106 (6.3%)	265 (11%)
No. variable sites	155	136	266
No. of trees (Fitch)	3291	3696	27405
Tree length	497	314	857
CI	0.68	0.78	0.73
RI	0.78	0.84	0.77
Average number of changes per variable site (number of steps/number of variable sites)	3.2	2.34	3.2
Model selected by Akaike information Criterion	GTR + I + G	<i>rps16</i> : GTR + I + G <i>trnL-trnF</i> : SYM + I + G	

4.3 Discussion

The high genetic variability shown by the ITS region has over the years ensured its frequent use in phylogenetic analyses in various plant families, including the Asteraceae (Baldwin, 1992; Baldwin et al., 1995; Albach and Chase, 2004). As expected, the ITS region was the most informative of the regions used in the present study, with the highest percentage of parsimoniously informative characters (15.9%), while a lower percentage of 6.3% was recorded in the combined plastid regions (Table 4.1). The relationships among the species revealed in this study differ slightly from those shown by Pelsner et al. (2007), most notably in the position of the genus *Euryops*. Analyses in

this study place *Euryops* within a clade including *Hertia* and *Lopholaena* whereas it was placed as sister to *Othonna* in Pelser et al. (2007).

The sister relationship between *Gymnodiscus* and *Crassothonna* recovered by Pelser et al. (2007) was well supported in all analyses in the present study. The two genera are morphologically very different from one another. *Gymnodiscus* (2 spp.) is the only annual genus in the Othonninae (Magoswana et al., 2016), and the only other annual species in the subtribe is *Euryops annuus* Compton, which is placed as sister to the rest of the genus in Devos et al. (2010). Magoswana et al. (2016) explored the possibility of a close relationship between *Gymnodiscus* and the dwarf succulent species of *Othonna* (*Othonna cacalioides* L.f. and its allies) due to the shared ray florets with a very short pappus, and disc florets with the pappus sometimes reduced to one or two small caducous bristles. However, this relationship was not recovered in the analyses of the present study nor in those of Pelser et al. (2007).

Analyses of this study support the monophyly of *Othonna* as currently circumscribed. The genus had previously been found to fall into two separate and morphologically distinct clades (Pelser et al. 2007). The segregation of the succulent terete-leaved taxa (now *Crassothonna*) from *Othonna* s. str. first shown by Pelser et al. (2007) is supported by the results presented here. The position of *O. undulosa* is uncertain, with conflicting positions in the nuclear and chloroplast datasets (Figs 4.1–4.4). *Othonna undulosa* was recovered within the genus *Hertia* in the chloroplast datasets but within the '*O. bulbosa*' group in the nuclear datasets. Morphologically *O. undulosa* has a number of features in

common with *O. perfoliata* and *O. rufibarbis* in the '*O. bulbosa*' group, notably its geophytic habit with elongate stems, and sessile, amplexicaul cauline leaves. The disc florets with undivided styles, and the accrescent pappus of the ray florets are both diagnostic for *Othonna*. In contrast, species of *Hertia* are shrubs or shrublets, with the styles of disc florets divided, and the branches hairy on the outside. In order to confirm the position of *O. undulosa*, further samples of this species need to be added to a broader analysis of *Othonna*.

Harvey (1865) divided *Othonna* into six informal groups based largely on habit and branching of the inflorescence. The geophytic species of *Othonna* were divided between the *Scapigeræ* (corresponding to the '*O. auriculifolia*' group in the present study) with ca. 3 species distinguished by the rosulate habit with a short, condensed caudex, and the *Caulescentes* (corresponding to the '*O. bulbosa*' group in the present study) with 23 species distinguished by the well-developed stem bearing cauline leaves. While a clade comprising the species belonging to the '*O. bulbosa*' group was recovered in the nuclear and combined analyses, the two species from the '*O. auriculifolia*' group included in the analyses were not recovered with the other geophytic species and also not close to one another. The two taxa, *O. auriculifolia* and *O. taraxacoides*, are distinguished essentially by having the crown at or near ground level and the annual stem highly condensed without evident internodes, thus appearing unbranched. They differ from each other largely by the condition of the capitula, radiate in *O. auriculifolia* and disciform in *O. taraxacoides*. In spite of their shared features, the

two taxa do not form a single monophyletic group but are rather divided among the clades within the genus. Further sampling is necessary to confirm their relationship.

Members of the *O. arbuscula* clade of *Othonna* are mostly shrubs or shrublets with radiate capitula but some are perennial herbs or succulents with disciform capitula. The clade comprises a combination of species previously assigned to various sections of *Othonna* plus the genus *Doria* in Harvey's (1865) account of the genus. This study further supports the inclusion of *Doria* within an expanded *Othonna*. The relationship of the disciform taxa to each other and to the radiate taxa is not clear as the disciform taxa are found in conflicting positions in all trees. Lack of resolution in the acquired trees impedes interpretation of the evolutionary history of *Othonna*. *Othonna quiquidentata* (a shrub to 1 m high with yellow radiate heads) is resolved as sister to the rest of *Othonna*. This will, however need further investigation to confirm.

Although three gene regions were used in this study (ITS, *rps16* and *trnL-trnF*), the resulting phylogenies were mostly unresolved. Apparent hard incongruence between the trees from the different gene regions was found in the position of *O. undulosa*. Additional accessions of this species need to be collected and also included in the analyses to rule out sequencing error.

CHAPTER 5

TAXONOMY OF THE '*O. BULBOSA*' GROUP

5.1 The genus *Othonna*

Othonna L., Sp. Pl. 2: 924. (1753); L., Gen. Pl. 5: 396 (1754); L.f., Suppl. Pl.: 386 (1782); Less., Syn. Comp. 88 (1832); DC., Prodr. 6: 473 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 327 (1865); Merxm., Prodr. Fl. Südwestafr. 139: 129 (1967); Hilliard, Compositae in Natal: 513 (1977); K.Bremer, Asteraceae: 506 (1994); G.D.Rowley, The succulent Compositae: 155 (1994); Leistner, Seed plants of southern Africa: 153 (2000); Anderberg et al. in Kubitzki., Fam. & Gen. Vasc. Pl. 8: 237 (2007); Manning & Goldblatt, Plants of the Greater Cape Floristic Region: 406 (2012); Snijman, Plants of the Greater Cape Floristic Region. 2: The Extra Cape Flora: 309 (2013). Type: *O. coronopifolia* L., lecto., designated by Green: 184 (1929).

Doria Thunb., Nov. Gen. Pl. 12: 162. (1800); Less., Syn. Comp. 89 (1832); DC., Prodr. 6: 469 (1838); Sch. Bip. in Flora 27(2): 769 (1844); Harv. in Harv. and Sond., Fl. Cap. 3: 320 (1865). Type: Not designated.

Shrubs or subshrubs, geophytes, and succulents, up to 2 m tall, stems erect or suberect to decumbent or sprawling, crown and leaf axils cobwebbed; sometimes with tuberous rootstock. Leaves alternate, sometimes crowded basally, prostrate or spreading to suberect, sessile or pseudo-petiolate, linear to ovate or obovate-spatulate or lyrate to pinnatisect, sub-succulent or leathery. Inflorescence terminal, pedunculate,

capitula solitary or laxly cymose or paniculate, peduncles glabrous or pubescent basally. *Capitula* heterogamous, radiate or disciform. *Involucre* campanulate, bracts uniseriate, free, lanceolate to elliptic or oblong, glabrous, green with scarious margins and darker apices. *Receptacle* conical, punctate, glabrous, epaleate. *Outer florets* female fertile, usually yellow and sometimes white, rarely pink to mauve, filiform or ligulate, limb oblanceolate to elliptic or oblong; ovary ellipsoid to obovoid, glabrous or appressed-puberulous with white twin hairs; style terete, with slightly thickened base, branches with discrete lateral stigmatic areas, apices oblanceolate and shortly papillate. *Cypselas* ellipsoid to obovoid, 10-ribbed, dark brown, densely appressed-puberulous with myxogenic or non-myxogenic white twin hairs, rarely glabrous; pappus bristles many, 2–20 mm long, basally united, barbellate, persistent, beige or sometimes banded deep red. *Disc florets* functionally male, numerous, yellow or white to blue or pink, perianth tube funnel-shaped, 5-lobed, lobes spreading; anthers obtuse at base with ovate apical appendages, filament collar balusteriform; ovary narrowly ellipsoid, glabrous; style simple and cone-tipped, rarely with short branches but then without lateral stigmatic zones; pappus of ± 10 barbellate bristles, sometimes reduced to one or two bristles and lacking in one species, united basally, white.

Distribution and ecology: ± 120 spp., largely restricted to the Greater Cape Floristic Region, with a few species in the eastern summer rainfall regions of South Africa and some extending to Angola and Zimbabwe; usually on sandy flats or rocky slopes, rarely seasonally damp sandy flats.

Diagnosis: deciduous geophytes, shrubs or subshrubs and succulents; peduncles bearing one to several capitula in corymbs; leaves alternate, simple to

pinnatisect, leathery or sub-succulent; capitula heterogamous, radiate or disciform, yellow or pink to mauve; outer florets functionally female, cypselas ellipsoid, 10-ribbed, densely appressed-puberulous on ribs with myxogenic or non-myxogenic white twin hairs; pappus bristles many, beige or banded with red, sometimes elongating up to 20 mm long; disc florets male-fertile with undivided, cone-tipped style, rarely bifid but lobes not stigmatic; pappus of (0) 1–10 bristles.

5.2 The *Othonna bulbosa*-group

Deciduous geophytes with short underground stem branching shortly above ground level or sparsely branched in upper half, stems erect or suberect to decumbent or sprawling, felted at crown and thinly cobwebbed or sometimes glabrous in axils; with obovoid to turnip-shaped rootstock. *Leaves* crowded basally or evenly spaced above, lowermost largest, spreading to erect, sessile and clasping or base narrowed and petiole-like, linear to ovate or obovate-spatulate or lyrate to pinnatisect, sub-succulent or leathery, upper leaves progressively smaller, sessile and sometimes clasping, uppermost leaves bract-like, cordate to linear. *Capitula* radiate or disciform. *Outer florets* usually yellow, rarely pink to magenta; ovary appressed-puberulous with twin hairs or rarely glabrous. *Cypselas* densely appressed-puberulous with myxogenic or non-myxogenic white twin hairs, rarely glabrous; pappus bristles 2–20 mm long, beige or sometimes banded deep red. *Disc florets* usually yellow, rarely white to blue or magenta; pappus of $\pm$ 10 barbellate bristles or lacking in one species.

Distribution and ecology: 23 spp., restricted to the Greater Cape Floristic Region, from southern Namibia through the Core Cape Floristic Region as far east as St Francis Bay in Eastern Cape; usually on sandy flats or gentle slopes in sandy soils or damp sandy flats.

Diagnosis: deciduous geophytes branching shortly above ground level or in the upper half with peduncles bearing one to several capitula in corymbs; capitula radiate or disciform, usually yellow or rarely pink to magenta; cypselas of ray florets densely appressed-puberulous on ribs with myxogenic or non-myxogenic white twin hairs; pappus bristles many, up to 20 mm long; pappus of disc florets of ± 10 bristles but lacking in one species.

5.3 Infrageneric classification

The species of the *Othonna bulbosa* group are divided into the following four morphologically diagnosable groups based on habit, capitula type and ray colour. These four groups are treated as the series *Bulbosae* (13 spp.), distinguished by radiate capitula and yellow ray florets, and the pappus of the marginal florets $\pm$ as long as the cypselae (Fig. 3.1A–G and I); series *Roseae* (3 spp.), with radiate capitula and pink to magenta ray florets, and the pappus of the marginal florets $\pm$ as long as the cypselae or only slightly longer; series *Disciformes* (3 spp.), with disciform capitula, and filiform, female-fertile outer florets (Fig. 3.1H), and the pappus of the marginal florets enlarging to twice the length of the cypselas; and series *Perfoliatae* (3 spp.), with scandent or sometimes erect stems, the leaves strictly cauline and scattered evenly along the stem,

sessile and clasping or auriculate, (Fig. 3.1H), the capitula either radiate or disciform and the pappus of the marginal florets $\pm$ as long as the cypselae. Outgroup comparison with related genera in the *Crassothonna/Euryops/Gymnodiscus*–lineage of the subtribe Othonninae (Pelser et al. 2007, Nordenstam et al. 2009) suggest that pink to magenta ray florets, disciform capitula with filiform outer florets, scandent stems with sessile, clasping leaves, and glabrous cypselas are derived conditions for *Othonna*. Species of the genera in the *Crassothonna/Euryops/Gymnodiscus*–lineage are largely shrubs or shrublets or rarely annual herbs with consistently radiate and yellow capitula. Based on this comparison, we interpret that the ancestral states in *Othonna* are probably simple leaves and radiate capitula with yellow flowers (a colour most common in the genus). Of the four series recognised, all but series *Bulbosae* are believed to represent monophyletic groups. The arrangement of species in each series begins with those with yellow, radiate capitula and simple leaves and progresses to species with increasingly complex leaf morphology, disciform capitula or derived magenta florets.

5.4 Key to the species of the *O. bulbosa*-group

1a. Capitula disciform, marginal florets filiform:

2a. Plants erect or scandent, often growing through surrounding shrubs; leaves strictly cauline, clasping or amplexicaul; involucral bracts 10 or 12...**17. *O. undulosa***

2b. Plants erect, free-standing; leaves crowded at base of stem, lowermost leaves narrowed at base or sub-petiolate; involucral bracts 8 to 14:

3a. Leaves linear to narrowly lanceolate, 4–8 mm wide...**20. *O. linearifolia***

3b. Leaves elliptic to oblanceolate, sometimes cuneate, 10–60 mm wide:

4a. Cypselas and marginal ovaries pubescent; disc florets without a pappus, rarely with 1 or 2 bristles; florets yellow; involucral bracts 10 to 14...**18. *O. gymnodiscus***

4b. Cypselas and marginal ovaries glabrous; disc florets with well-developed pappus; florets blueish or white, involucral bracts 8 or 9...**19. *O. digitata***

1b. Capitula radiate, marginal florets ligulate:

5a. Ray florets pink:

6a. Involucre 5–15 mm diam., bracts 9 or 10; leaves 20–70 × 20–50 mm...**22. *O. lilacina***

6b. Involucre 10–25 mm diam., bracts 12 or 13; leaves 25–375 × 20–155 mm:

7a. Leaves denticulate to dentate or sharply pinnatifid with acute lobes...**21. *O. rosea***

7b. Leaves trifid to pinnatisect with obtuse lobes...**23. *O. cakilefolia***

5b. Ray florets yellow, sometimes flushed reddish beneath:

8a. Plants erect or scandent, often growing through surrounding shrubs; leaves strictly cauline, clasping or amplexicaul:

9a. Plants erect, free-standing; involucral bracts 12 or 13; plants from Jeffrey's Bay to Port Elizabeth...**16. *O. rufibarbis***

9b. Plants usually straggling through surrounding shrubs; involucral bracts 8 or 9; plants from Namaqualand to Knysna...**15. *O. perfoliata***

8b. Plants erect, free-standing; leaves crowded at base of stem, lowermost leaves narrowed at base or sub-petiolate:

10a. Leaves pinnate, leaflets separated along rachis, elliptic with conspicuous hyaline margins:

11a. Capitula usually one headed, sometimes two headed; branched from the lower half, peduncles 15–200 mm long...**12. *O. pinnata***

11b. Capitula usually up to three heads, rarely one headed; branched from the upper third, peduncles 10–60 mm long...**13. *O. tephrosioides***

10b. Leaves simple to pinnatisect:

12a. Involucral bracts 7 to 10:

13a. Leaves linear or filiform, 2–10 mm wide; capitula small, involucre 5–10 mm diam.; plants from seasonal wetlands...**14. *O. stenophylla***

13b. Leaves lanceolate to obovate-spathulate, 10–75 mm wide; capitula larger, involucre 8–20 mm diam.; plants from drier flats and slopes:

14a. Leaves twice as long as broad, deeply pinnatisect, with quadrate lobes equally spaced along axis...**9. *O. rotundiloba***

14b. Leaves usually less than twice as long as broad, entire, pinnatifid or variously lobed but lobes not evenly spaced along axis:

15a. Leaves obovate-spathulate...**6. *O. intermedia***

15b. Leaves elliptic to ovate:

16a. Leaf margins sinuate, blade oblanceolate, base narrowed and winged to a short petiole± 10 mm long; plants from Piketberg...**2. *O. sinuata***

16b. Leaf margins lyrate or lacerate, blade oblong to ovate, conspicuously petiolate with petiole up to 70 mm long; plants from Vanrhynsdorp to Wuppertal:

17a. Leaf margins lyrate...**7. *O. lyrata***

17b. Leaf margins lacerate...**8. *O. petiolaris***

12b Involucral bracts 12 to 14:

18a. Petioles often subterranean ...**5. *O. hederifolia***

18b. Petioles always inserted above ground level:

19a. Basal leaves roughly puberulous on both surfaces, margins undulate-incised or crenate...**3. *O. heterophylla***

19b. Basal leaves glabrous, margins entire, variously lobed or pinnately cut:

20a. Basal leaves sessile, 20–300 mm long ...**10. *O. macrophylla***

20b. Basal leaves narrowed or petiolate, 10–155 mm long:

21a. Perianth tube of ray floret 5–6 mm long ...**11. *O. oleracea***

21b. Perianth tube of ray floret 4–5 mm long:

22a. Basal leaf blades ovate to oblong or oblanceolate, entire or sometimes trilobed or pinnatifid; peduncles sometimes puberulous in basal half; involucre 10–25 mm diam..

...**1. *O. bulbosa***

22b. Basal leaf blades cuneate to obovate or pandurate, coarsely dentate or undulate-incised; peduncles glabrous; involucre 8–15 mm diam.... **4. *O. cuneata***

5.5 The species of the '*O. bulbosa*' group

Ser. *Bulbosae* Magoswana and J.C. Manning, *ser. nov.* Type: *O. bulbosa* L.

Deciduous geophytes with short underground stem branching shortly above ground level; capitula radiate with yellow ray florets; pappus not or slightly elongating, 3–12 mm long, beige.

1. ***Othonna bulbosa*** L., Sp. Pl. 1309 (1753). *Othonna tuberosa* Thunb., Fl. Cap.: 718 (1823), *nom. illeg. superfl.* Type: illustration in Breyne, in Exot. Pl. Cent.: 138, t. 66 (1678), *lecto.*, designated by Nordenstam in Jarvis, Order out of Chaos: 714 (2007).

Othonna lingua L.f., Suppl. Pl.: 388 (1782); Harv. in Harv. and Sond., Fl. Cap. 3: 342 (1865). *Doria lingua* (L.f.) DC., Prodr. 6: 471 (1838); Less., Syn. Comp.: 89 (1832) [as ' (Jacq.) Less.']; Sch.Bip. in Flora 27(2): 769 (1844) [as '(Less.) Sch. Bip.']. Type: South Africa, without precise locality, *UPS-THUNB 20882* (UPS-THUNB, presumed *holo.*).

Othonna adscendens DC., Prodr. 6: 480 (1838), *syn. nov.*; Harv. in Harv. and Sond., Fl. Cap. 3: 342 (1865). Type: South Africa, [Western Cape], 'in Africae Capensi circa urbem', without date, *Ecklon [1786]* (G-DC, *holo.*—microfiche!; HAL—image!, *iso.*).

Othonna oblongifolia DC., Prodr. 6: 480 (1838), *syn. nov.*; Harv. in Harv. and Sond., Fl. Cap. 3: 342 (1865). Types: South Africa, [Western Cape], 'in Africae Capensi circa urbem', without date, *Ecklon [1559]* (G-DC—microfiche!, *syn.*; HAL—image!, M—image!, *isosyn.*); South Africa, [Western Cape], 'Kaapsche vlakte', without date, *Dregè [384]* (G-DC—microfiche!, *syn.*).

Othonna elliptica DC., Prodr. 6: 480 (1838), *syn. nov.* Type: South Africa, Western Cape, Worcester (3319): 'in Africâ Capensi ad Draakenstensberg', (–CC), without date, *Drège* [6072] (G-DC, holo.—microfiche!).

Deciduous geophyte, to 35 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock oblong or turnip-shaped. *Leaves* crowded basally, erect, conspicuously petioled, blade ovate to oblong or oblanceolate, 25–140 × 10–55 mm, entire or sometimes trilobed or pinnatifid, lobes acute, leathery to sub-succulent, glabrous or rarely puberulous, upper leaves sessile and sometimes clasping, 20–60 × 10–25 mm, uppermost leaves lanceolate to elliptic, 2–10 × 1–5 mm. *Inflorescence* of one to two capitula, sometimes with lateral axes; peduncles 40–290 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 10–25 mm diam., involucre bracts 12 or 13, lanceolate, 5–12 × 2.0–2.5 mm. *Ray florets* 12 or 13, perianth tube 3.0–4.5 mm long, limb elliptic-ovate, 9–11 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* ellipsoid-ovoid, 5.5–6.5 × 1.5–2.0 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 5–7 mm long, beige. *Disc florets* numerous, perianth tube 1.0–1.8 mm long, lobes lanceolate to ovate, 0.6–1.0 mm long; filaments 1.0–1.7 mm long; ovary 3–5 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: occurring along the west coast and near interior of Western Cape from the Cold Bokkeveld north of Ceres to Bredasdorp and Albertinia on the south coast, with an outlying population inland near Oudtshoorn in the Little Karoo

(Fig. 5.1); on sandy slopes and flats, flowering best after fire. Flowering from April to October.

Diagnosis: *Othonna bulbosa* is a vegetatively variable species, with glabrous (rarely puberulous), petiolate, oblanceolate leaves, sometimes trilobed or pinnatifid (Fig. 3.3N1–N3), and moderately large capitula with the involucre 10–25 mm diam. and with 13 or 14 involucral bracts and ray florets. *Othonna heterophylla* has similar capitula but roughly hairy peduncles and leaves, with the margins mostly slightly toothed to crenate.

Candolle (1838) and Harvey's (1865) incorrect application of the name *Othonna lingua* arose from a misunderstanding in Jacquin's (1797) illustration of a plant described as an erect-stemmed, tuberous geophyte with petiolate, radical, lanceolate cauline leaves, and disciform capitula. Although the cypselas of *O. lingua* (Linnaeus, 1782) were described as glabrous, this observation was based on immature fruits, and in such cases the hairs are usually not readily seen. With more material available to him, Harvey (1865) in his description of *Doria lingua* described the cypselas as 'hispidulous'. The variation in leaf shape and leaf margin in *Othonna bulbosa* led Candolle (1838) to recognise a number of these forms as species. *Othonna elliptica* DC., based on a collection from the Drakenstein Mountains near Stellenbosch, was distinguished by elliptic leaves; *O. adscendens* DC., from an unlocalised collection, by its oblong-lanceolate leaves, and *O. oblongifolia* DC., from the flats around Cape Town, by its oblong to elliptic leaves. There are no differences in bract number among these taxa and *O. bulbosa* and the variation in leaf shape is taxonomically insignificant.

Additional specimens examined

South Africa. WESTERN CAPE: **3219 (Wuppertal)**: on R303 to Ceres and Citrusdal, Blinkberg Pass, foothills below Bloukop (–CB), without date, *Koekemoer 2399* (PRE). **3318 (Cape Town)**: Cape Town to Malmesbury Road (–BC), 06 Sep 1973, *Montgomery 513* (NBG); Kersefontein Farm (–AB), 10 Sep 1979, *Boucher 4672* (NBG); Buffels River dam site (–CB), 28 Aug 1971, *Bohlman and Bornowski 12* (NBG); Mamre, Groenekloof (–CB), Nov 1878, *Bolus 4290* (BOL); Table Mountain slopes (–CD), Aug 1881, *Tyson 2477* (NBG); Table Mountain (–CD), Sep 1912, *Marloth 2592* (PRE); Isoëtes Vlei (–CD), 13 Aug 1962, *Barker 9745* (NBG, PRE); Kenilworth Racecourse (–CD), 05 Jul 1903, *Phillips 195* (NBG); slopes above Cape Town (–CD), Sep 1917, *Marloth 8104* (PRE); Kuilsriver flats (–CD), Aug 1918, *Duthrie 814* (NBG); Brackenfell (–CD), 13 Aug 1948, *Compton 20737* (NBG); near Camps Bay (–CD), Sep 1919, *Flanagan s.n.* (PRE); Table Mountain above Cecelia Gorge (–CD), 27 Aug 1980, *Esterhuysen 17413* (BOL); Jonkershoek State Forest, Biesievlei Catchment (–DD), 18 Jul 1945, *Rycroft 885* (NBG); 18 Jul 1945, *Rycroft 885* (NBG); Stellenbosch, Guardian Peak, (–DD), 21 May 1942, *Esterhuysen 7836* (BOL); 31 May 1942, *Esterhuysen 7836* (PRE). **3319 (Worcester)**: Haalhoek Sneeuwkop (–AA), 24 May 1953, *Esterhuysen 21399* (BOL); Ceres, Karooport (–BC), Aug 1919, *Marloth 9004* (PRE); Bain's Kloof Pass (–CA), 26 Aug 2015, *Manning and Magoswana 3532* (NBG); Waaihoek Sneeuwkop (–CB), 24 May 1953, *Esterhuysen 21399* (PRE); Goudini Valley (–CB), Aug 1925, *Leipoldt s.n.* (BOL); Zachariashoek experimental site, Kasteelkloof catchment (–CC), 13 Jul 1978, *Lamb 93* (PRE). **3322 (Oudtshoorn)**: Boomplaasfontein, Cango Valley (–AC), 27 Jun 1974, *Moffett 246* (NBG). **3418 (Simonstown)**: Retreat (–AB), 01 Jul 1940, *Salter 7179*

(BOL); Gleincainr, Jonkersdam along path through Solole Game Reserve (–AB), 28 Aug 2006, *Cowell, Nurrish and Peuker MSBP3168* (NBG); Muizenberg Mountain (–AB), 11 Jul 1942, *Compton 13295* (NBG); Wynberg (–AB), Sep 1884, *Bolus s.n.* (BOL); Schuster's Kraal (–AB), 26 Jul 1942, *Compton 13341* (NBG); Red Hill (–AB), 31 May 1915, *Pillans 3004* (BOL); 05 Aug 1963, *Taylor 4974* (NBG); Vlakkenberg (–AB), 05 May 1935, *Levyngs 6570* (BOL); Cape Point, Olifantsbos (–AD), 28 Aug 1944, *Compton 15845* (NBG); Cape of Good Hope Nature Reserve, Kromrivier (–AD), 09 Aug 1967, *Taylor 7119* (BOL, PRE); Platboom (–AD), 20 Jul 1942, *Compton 13319* (NBG); Cape of Good Hope Nature Reserve, enclosure at Gifkommetjie turnoff (–AD), 07 Sep 1972, *Taylor 8190* (NBG); Kogelberg State Forest (–BB), 09 Aug 1977, *Durand 234B* (PRE); Sir Lowry's Pass (–BB), Oct 1880, *Bolus 5546* (BOL); Kogelberg Forest Reserve, above Oudebos Forest (–BD), 21 Jun 1969, *Boucher 395* (NBG, PRE); 10 May 1970, *Boucher 1286* (NBG). **3419 (Caledon):** Boesmanskloof (–AA), 21 May 1979, *Hugo 1815* (NBG); Swartberg (–AB), 10 Oct 1951, *Esterhuysen 18952* (BOL); Vogelgat (–AD), 11 Jun 1982, *Williams 3552* (NBG); along dirt road past Franskraal in SE direction (–CB), 04 Jul 1976, *Neethling s.n.* (NBG); road to Pearly Beach (–CB), 10 Jun 1950, *Martin 363* (NBG); Aasfontein Reserve (–DD), 10 Aug 1983, *Esterhuysen 35997* (BOL, PRE). **3420 (Bredasdorp):** The Poort (–AA), 10 Aug 1949, *Steyn 352* (NBG); De Hoop, Potberg Nature Reserve (–BC), 25 Jul 1979, *Burgers 2005* (NBG, PRE); 27 Jul 1962, *Acocks 22510* (PRE); Zeekoevlei, on Hillock near the Heuningklip River bridge (–CA), Sep 1926, *Smith 3094* (PRE). **3421 (Riversdale):** Albertinia road, 2 km W of Dekriet (–BC), 26 Jul 1974, *Bohnen 606/2* (NBG, PRE).

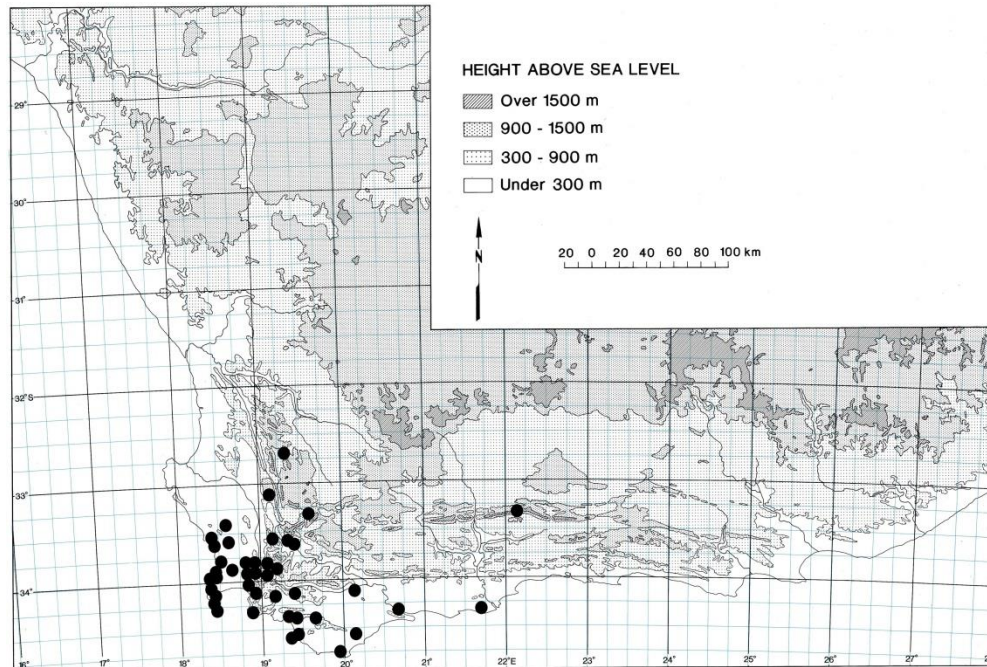


Figure 5.1: Known distribution of *O. bulbosa*.

2. ***Othonna sinuata*** Magoswana and J.C. Manning, *sp. nov.* Type: South Africa, Western Cape, Clanwilliam (3218): hills above Aurora, (–CB), 08 Aug 1962, *Barker* 9726 (NBG, holo.).

Deciduous geophyte, to 50 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock obovoid or turnip-shaped. Leaves crowded basally, erect to spreading, base narrowed and petiole-like, blade oblanceolate to elliptic, 60–140 × 15–40 mm, sinuate or sometimes incised, leathery to sub-succulent, glabrous or sometimes pubescent on midvein, upper leaves sessile and sometimes clasping, 30–110 × 5–25 mm, uppermost leaves lanceolate to elliptic, 3–10 × 1–6 mm. *Inflorescence* of one capitulum, sometimes with lateral axes; peduncles 70–390 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 8–15 mm diam., involucre bracts 7 or 8, oblanceolate to elliptic, 6–9 × 1–3 mm. *Ray florets* 7 or 8, perianth tube 2–

4 mm long, limb elliptic-ovate, 8–10 × 2–4 mm; ovary oblong to oblanceolate, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* ellipsoid to obovoid, 4–6 × 1–3 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 4–6 mm long, beige. *Disc florets* numerous, perianth tube 0.5–1.5 mm long, lobes lanceolate to ovate, 0.4–1.0 mm long; filaments 1–2 mm long; ovary narrowly ellipsoid, 3–6 mm long, glabrous; pappus of ± 10 barbellate bristles united basally (Fig. 5.2).

Distribution and ecology: known only from two collections from the Piketberg and the adjacent Olifants River Mountains along the West Coast of Western Cape (Fig 5.3); on sandy flats at altitudes below 500 m. Flowering from May to September.

Diagnosis: *Othonna sinuata* is recognised by the oblanceolate leaves narrowed to a petiole-like base, with sinuate margins and sometimes pubescent on the midvein, and the 7 or 8 involucral bracts. It has been treated in *O. bulbosa* in the past but that species has mostly larger capitula with 12 or 13 involucral bracts.

Etymology: This species epithet refers to the sinuate leaf margins.

Additional specimen examined

South Africa. WESTERN CAPE: **3218 (Clanwilliam)**: Citrusdal, Warm Baths (–DB), Jul 1915, *Bolus s.n.* (NBG).



Figure 5.2: *Othonna sinuata*. (A) flowering plant; (B) leaf; (C) involucral bract; (D) ray floret; (E) disc floret; (F) cypsela (ray floret); (H) style (disc floret); (I) anther. Voucher: *Barker 9726*, NBG. Scales: (A and B) 1 cm; (C–F) 1 mm; (G and H) 500 μ m.

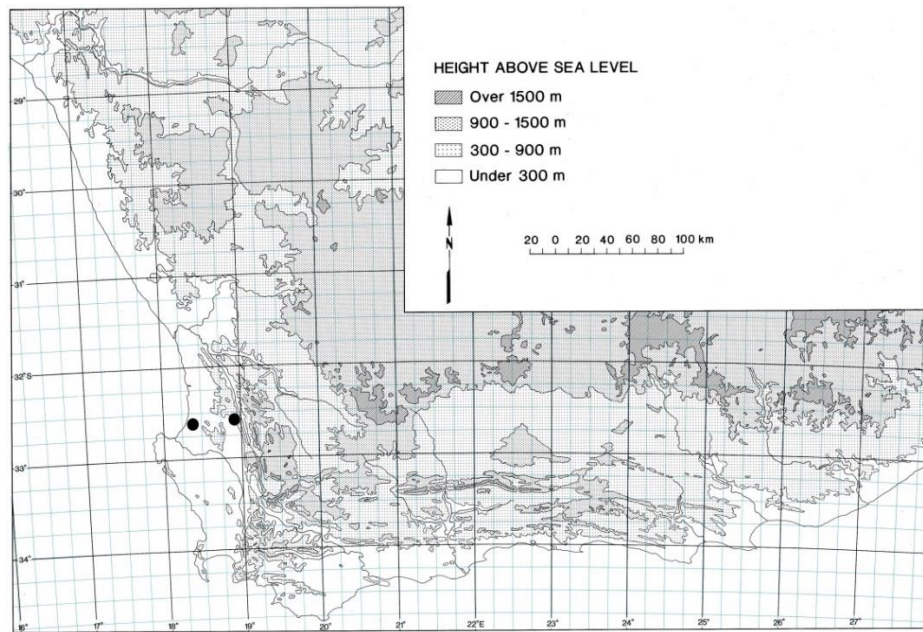


Figure 5.3: Known distribution of *O. sinuata*.

3. *Othonna heterophylla* L.f., Suppl. Pl.: 387 (1782); Harv. in Harv. and Sond., Fl. Cap. 3: 342 (1865). Type: South Africa, [Western Cape], 'Cap Bonae Spei' [crescit in collibus et campis arenosis extra urbem (*Thunberg* 1823)] [without date], *Thunberg s.n.* [UPS-THUNB 20879] (UPS-THUNB, lecto.—microfiche!, designated here; SBT—image! [SBT13711], isolecto.).

Othonna brachypoda DC., Prodr. 6: 480 (1838). Type: South Africa, [Western Cape], 'Cap Bonae Spei', without date, *Ecklon* [555, 4194] (G-DC—image!, syn.).

Deciduous geophyte, to 30 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock turnip-shaped. Leaves crowded basally, spreading, conspicuously petiolate, blade cuneate to oblanceolate, 20–110 × 15–70 mm, undulate-incised or crenate, leathery to sub-succulent, puberulous

on both surfaces, upper leaves sessile and sometimes clasping, 15–50 × 10–30 mm, uppermost leaves lanceolate to elliptic, 5–10 × 2–4 mm. *Inflorescence* of one capitulum, sometimes with lateral axes; peduncles 80–220 mm long, puberulous. *Capitula* radiate, yellow. *Involucre* 10–25 mm diam., involucral bracts 13 or 14, lanceolate to elliptic, 10–12 × 1–3 mm. *Ray florets* 13 or 14, perianth tube 2–4 mm long, limb oblong, 10–14 × 2–4 mm; ovary ellipsoid to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* ellipsoid to obovoid, 3–4 × 1–2 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 4–6 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes ovate, 0.5–1.0 mm long; filaments 1–2 mm long, ovary 4–6 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: relatively common on the southwestern coastal mountain slopes of Western Cape, from Tulbagh to Hermanus, but with scattered collections north onto the Bokkeveld Escarpment and east to Swellendam (Fig. 5.4); on rocky sand and clay slopes at altitudes below 1 000 m. Flowering from May to September.

Diagnosis: *Othonna heterophylla* is distinctive in its cuneate to oblanceolate leaves puberulous on both surfaces and with undulate-incised or crenate margins (Fig. 3.3G1–G2). The peduncles are also puberulous. *Othonna bulbosa*, with similar capitula, has mostly glabrous (rarely puberulous) leaves, sometimes lobed but always with entire margins, and glabrous peduncles.

Additional specimens examined

South Africa. NORTHERN CAPE: **3119 (Calvinia)**: Lokenburg (–CA), 29 Aug 1953, *Acocks 17061* (PRE).

WESTERN CAPE: **3118 (Vanrhynsdorp)**: Gifberg, Ordinansiekop N side (–DD), 14 Jul 1974, *Oliver 4953* (NBG). **3219 (Wuppertal)**: Cedarberg, Algeria Forest Station, De Rif (–AC), 27 May 1982, *Viviers 351* (NBG, PRE). **3318 (Cape Town)**: Paarlberg (–BB), 04 Jul 1962, *Kruger 123* (NBG); Table Mountain (–CD), 14 Jul 1918, *Pillans 3123* (PRE); Oudekraal 902, behind white hotel (–CD), 25 Aug 2009, *Helme 6477* (NBG); Kenilworth (–CD), 23 Jun 1938, *Salter 8182* (NBG); Paardeberg, between Wellington and Malmesbury, Vlakfontein ± 400 m S of the Perdeberg Dam (–DB), 09 Aug 2011, *Nicholson and Roets 258* (NBG); Jonkershoek State Forest (–DD), 05 Jul 1976, *Kruger s.n.* (PRE); Jul 1967, *Kerfoot 5860* (PRE); 05 Jul 1963, *Bos 146* (NBG, PRE); 05 Jun 1965, *Taylor 4862* (NBG, PRE); Jonkershoek State Forest, Swartboskloof (–DD), 23 May 1943, *Wicht s.n.* (PRE); 24 May 1943, *Borchardt s.n.* (PRE); 05 Aug 1964, *Taylor 5823* (PRE); Jonkershoek State Forest, Biesievlei catchment, (–DD), 23 Aug 1984, *Richardson 113* (NBG); 11 Jul 1967, *Bos 225*; 28 Jun 1967, *Bos 103* (NBG); 05 Jul 1976, *Kruger 184* (NBG); Stellenbosch, Jan Marais Park, (–DD), 14 Jun 1978, *Hugo 1222* (NBG). **3319 (Worcester)**: Elandsberg Private Nature Reserve (–AC), 26 Jun 1999, *Parker s.n.* (NBG); 21 Jul 1996, *Parker 41* (NBG); 10 Aug 2015, *Manning and Magoswana 3509* (NBG); Karooport (–BC), 18 Sep 1938, *Acocks 1705* (PRE); Du Toit's Kloof (–CC), 31 May 1952, *Esterhuysen 20173* (NBG, PRE); 20 Aug 1953, *Martin 1009* (NBG, PRE); 23 Aug 1953, *Esterhuysen 21714* (PRE); Klein Drakenstein Mountains, upper Kasteelkloof catchment (–CC), 01 Oct 1970, *Haynes H413*; 01 Oct 1971, *Kruger 1476* (NBG); Zachariashoek Experimental Catchment, Kasteelkloof catchment (–CC),

10 Aug 1972, *Haynes 676* (NBG, PRE); 03 Sep 1970, *Haynes H370* (NBG, PRE); Franschhoek Pass (–CC), 13 Jun 1980, *Hugo 2359* (NBG, PRE); Franschhoek Pass, Middagkransberg summit ridge (–CC), 11 Oct 1973, *Boucher 2408* (NBG); 12 May 1978, *Lamb 83* (PRE); Franschhoek (–CC), without month 1895, *Bolus s.n.* (PRE); Klein Drakenstein Mountains (–CC), 01 Oct 1970, *Haynes 413* (PRE). **3418 (Simonstown):** Houtbay (–AB), Aug 1924, *Marloth 11924* (PRE); Steenberg (–AB), 13 Sep 1942, *Compton 13638* (NBG); Kromriver (–AB), 10 Oct 1945, *Compton 17484* (NBG); Cape of Good Hope Nature Reserve, track over plateau to Hesterdam (–AB), 17 Jun 1972, *Taylor 8129* (NBG); Wynberg Flats (–BA), Aug 1924, *Alexander s.n.* (PRE); Van de Stel (–BB), Sep 1926, *Smith 3224* (PRE); Somerset West, Helderberg Nature Reserve (–BB), 15 Jul 1994, *Runnalls 691*; 18 Aug 1995, *Runnalls 815* (NBG); Kogelberg State Forest (–BB), 13 Sep 1977, *Durand 236* (PRE); Sir Lowry's Pass (–BB), Jul 1920, *Page and Guthrie s.n.* (PRE); Gordon's Bay (–BB), 12 Aug 1948, *Parker 4339* (NBG); Harmony Reserve, Strand (–BB), 31 Jul 2000, *Runnalls 1017*; 17 May 1975, *Oliver 5918* (NBG); Jonkershoek, Heuningkloof (–BB), Sep 1967, *Kerfoot K5950*; 14 Jun 1962, *Taylor 3394* (NBG). **3419 (Caledon):** Swartberg (–AB), Jul 1992, *Guthrie 578* (NBG); Hermanus Mountain above Golf Course (–AD), 11 Aug 1978, *Williams 2537* (NBG). **3420 (Bredasdorp):** near Swellendam (–AB), 10 Aug 1949, *Steyn 259* (NBG); Bontebok Park (–AB), 20 Jun 1962, *Acocks 22240* (PRE); 24 Aug 1965, *Grobler 476* (NBG); near Heidelberg (–BB), 12 Aug 1949, *Steyn 345* (NBG); Bredasdorp (–CA), Sep 1926, *Smith 2912* (PRE).

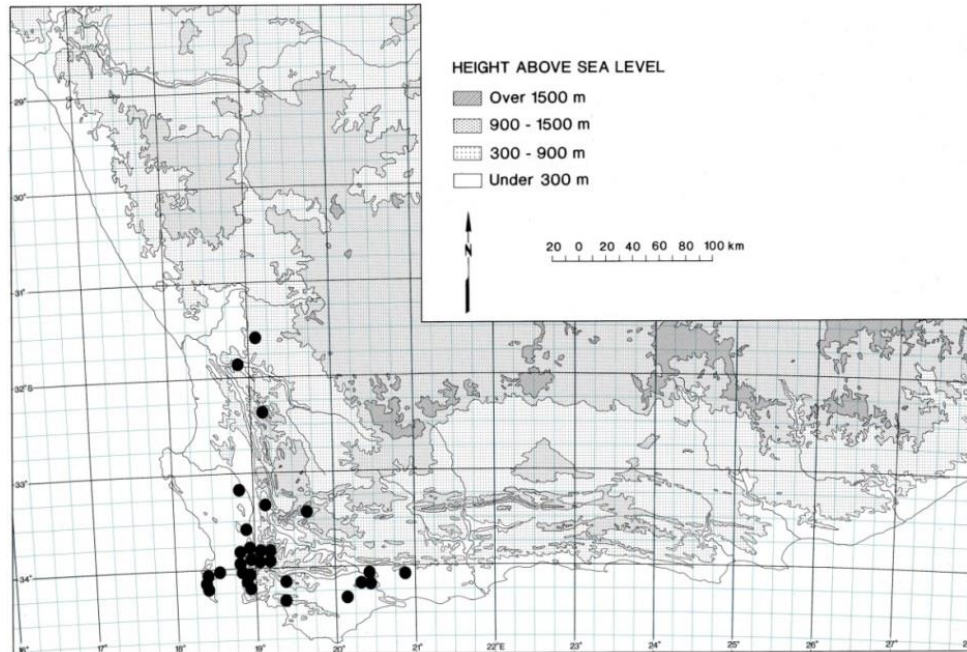


Figure 5.4: Known distribution of *O. heterophylla*.

4. ***Othonna cuneata*** DC., Prodr. 6: 481 (1838). Type: South Africa, Western Cape, Clanwilliam (3218): 'Cap. Bonae Spei in Lange-Valey et ad Olifantsrivier', (–BC), without date, Drège [2876] (G-DC, holo.—microfiche!; K—image!, P—image!, iso.).

Deciduous geophyte, to 30 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock obovoid to oblong. Leaves crowded basally, spreading, base narrowed and petiole-like, auriculate, blade cuneate to obovate and sometimes pandurate, 10–125 × 15–95 mm, entire or coarsely dentate or undulate-incised, leathery to succulent, glabrous, upper leaves sessile and sometimes clasping, 10–70 × 5–50 mm, uppermost leaves lanceolate to elliptic, 5–20 × 2–4 mm. Inflorescence of one to three capitula, sometimes with lateral axes; peduncles 20–150 mm long, glabrous. Capitula radiate, yellow. Involucre 8–15 mm diam.,

involucral bracts 12 to 14, oblanceolate to elliptic, 7–12 × 1–4 mm. *Ray florets* 12 to 14, perianth tube 3–5 mm long, limb oblanceolate to oblong, 9–12 × 2–3 mm; ovary ellipsoid to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* ellipsoid-ovoid, 4–7 × 1–3 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 3–8 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes ovate, 0.5–1.0 mm long; filaments 2–3 mm long; ovary 2–6 mm long; style simple and cone-tipped, rarely with short branches in some individuals but then without lateral stigmatic zones; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: relatively narrowly distributed in the drier western parts of South Africa, from the Piketberg and Cederberg through the Knersvlakte in the Western Cape into central Namaqualand in Northern Cape and also on the Roggeveld (Fig. 5.5); on quartz patches and sandstone flats. Flowering from May to September.

Diagnosis: *Othonna cuneata* (Fig. 3.3L) shares cuneate leaves with the apices variously coarsely toothed with *O. hederifolia* (Fig. 3.3M) but is distinguished by the smaller capitula, the involucre 8–15 mm diam. vs 12–20 mm diam., the glabrous, branching peduncles, and the somewhat succulent leaves narrowed below but without the filiform petioles of *O. hederifolia*. *Othonna cuneata* can sometimes be confused with *O. bulbosa* but that species has oblanceolate leaves, sometimes trilobed or pinnatifid and larger capitula.

As circumscribed here, *O. cuneata* displays a wide range of leaf shapes, ranging from cuneate to obovate and sometimes pandurate. It grows usually but not exclusively among white quartz pebbles.

Additional specimens examined

South Africa. NORTHERN CAPE: **3017 (Hondeklipbaai)**: Namaqualand National Park, S of Riethuis on track to Taaibosduin (–AB), 13 Aug 2006, *Koekemoer* 3352 (PRE); Namaqualand, Riethuis (–AB), without date, *Lavranos* 8050 (PRE); Namaqualand National Park, on track N of Oubees to Oubees-se-sand (–AB), 18 Aug 2007, *Steyn* 1337 (PRE); Leliefontein (–AB), 11 Sep 1992, *Bruyns* 5944 (BOL); Namaqualand National Park, on road to Soebatsfontein (–BA), 01 Sep 2004, *Koekemoer* 2847 (PRE); Garies (–CB), 25 Jul 1941, *Compton* 11079 (NBG); Grasberg, Paulshoek, Rooiwal just W of Grootberg (–CB), 20 Aug 1999, *Desmet* 162 (NBG). **3018 (Kamiesberg)**: Bitterfontein, Perdekop (–CD), 14 Jul 2006, *Bruyns* 10486 (NBG). **3019 (Loeriesfontein)**: Platklip (–CC), 17 May 2006, *Bruyns* 10503 (NBG). **3220 (Sutherland)**: 11 miles (18 km) S of Sutherland (–BC), 31 Jul 1953, *Acocks* 16839 (PRE).

WESTERN CAPE: **3118 (Vanhynsdorp)**: 7 km N of Kliprand road E of Nuwerus (–AB), 09 Sep 1976, *Hugo* 466 (NBG, PRE); Nuwerus (–AB), Aug 1949, *Compton* 11079 (NBG); Bitterfontein, hills E of Nuwerus (–AB), 12 Jul 2006, *Bruyns* 10469 (NBG); 7.8 km on Douse the Glim turn-off, 24 km N of Vanrhynsdorp (–BB), 05 Aug 1977, *Le Roux* 2070 (NBG); ± 3 km on Douse the Glim turn-off (–BB), 18 Aug 2015, *Manning and Magoswana* 3525 (NBG); Knersvlakte (–BC), 06 Sep 1950, *Maguire* 284 (NBG); Knersvlakte, Flaminkvlakte (–BC), 04 Aug 2012, *Koekemoer* 4295 (PRE); Knersvlakte (–BC), 23 Aug 1941, *Compton* 11329 (NBG); Knersvlakte, turn-off at Groot-Graafwater (–BC), 18 Aug 2015, *Manning and Magoswana* 3523 (NBG); Farm ‘Liebendal’ (–BC), 07 Sep 1981, *Hall* 5143 (NBG); Heerenlogementsberg (–DC), 21 Jul

1941, *Compton* 10982 (NBG) . **3218 (Clanwilliam)**: between Leipoldtville and Graafwater (–AB), 07 Jul 1941, *Leipoldt* 3642 (BOL); Graafwater, near old quarry on road to Clanwilliam (–BA), 04 Jun 1969, *Wisura* 313 (NBG); Piketberg Mountains (–DA), 12 Sep 1954, *Esterhuysen* 23109a (BOL). **3219 (Wuppertal)**: Kromriver–Eselbank sandy plains (–CB), 07 Feb. 1995, *Linder* 5953 (BOL); Kaggakamma Nature Reserve, 4x4 section between Bobbejaanskraans Camp and Joubertswerf (–DA), 10 Aug 2012, *Koekemoer* 4304 (PRE); Wuppertal (–DA), 31 Aug 1896, *Schlechter* 8787 (BOL, PRE).

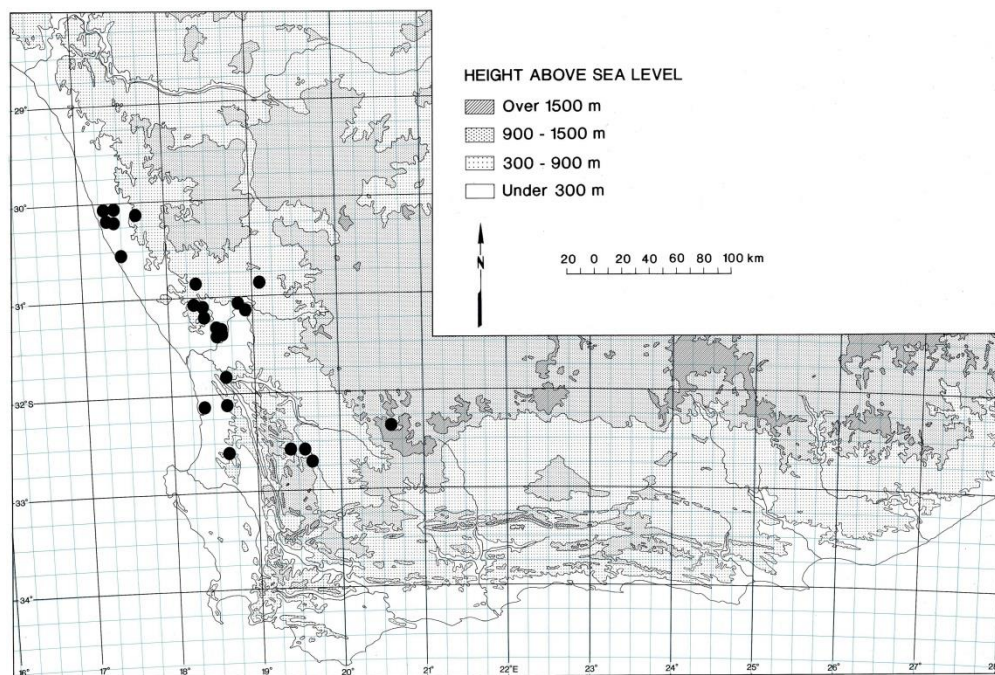


Figure 5.5: Known distribution of *O. cuneata*.

5. ***Othonna hederifolia*** B.Nord. in Bot. Not. 124 (1): 14 (1971). Type: South Africa, Northern Cape, Calvinia (3119): ‘top of Van Rhyn’s Pass’, (–AC), 19 Jul 1962, *Nordenstam* 679 (S, holo.—image!; AD—image!, BM—image!, BOL—image!, C—image!, G—image!, GZU—image!, K—image!, M—image!, MO—image!, NBG!, iso.).

Deciduous geophyte, to 30 cm, with short subterranean stem branching shortly below or above ground level, branches erect to sub-erect; rootstock oblong or turnip-shaped. *Leaves* crowded basally, erect, conspicuously petioled, petiole filiform, often subterranean, blade cuneate, 8–75 × 10–80 mm, coarsely and ± irregularly 8 or 9 dentate, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 15–40 × 5–10 mm, uppermost leaves lanceolate to elliptic, sessile, 6–13 × 1–3 mm. *Inflorescence* of one capitulum, sometimes with lateral axes; peduncles 40–280 mm long, puberulous in lower half. *Capitula* radiate, yellow, rays sometimes purple beneath. *Involucre* 10–20 mm diam., involucral bracts 12 or 13, lanceolate to elliptic, 8–15 × 2–4 mm. *Ray florets* 12 or 13, perianth tube 2–4 mm long, limb elliptic-ovate, 10–15 × 2–4 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 4–7 × 2–3 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 4–6 mm. long, beige. *Disc florets* numerous, perianth tube 1.5–2.0 mm. long, lobes ovate, 1.5–2.0 mm. long; filaments 2–3 mm; ovary 3–6 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: distributed along the drier mountains of western South Africa, from the Bokkeveld Mountains in Northern Cape through the Cederberg and Cold Bokkeveld to the Witteberg in Western Cape (Fig. 5.6); in shallow sandy soils on sandstone sheets in arid fynbos at altitudes above 1 500 m. Flowering from June to August.

Diagnosis: *Othonna hederifolia* is readily recognised by the conspicuously petioled leaves with cuneate, coarsely toothed blades protruding vertically above the

ground from slender subterrenan petioles (Fig. 3.3M), and by the peduncles that are puberulous in the lower half.

Additional specimens examined

South Africa. NORTHERN CAPE: **3119 (Calvinia)**: Oorlogskloof Nature Reserve, 15 km SSW of Nieuwoudtville (–AC), 19 Jun 1995, *Pretorious 250* (NBG); top of Van Rhyn's Pass (–AC), 22 Jul 1955, *Hall 53* (NBG); 29 Jul 1967, *Marsh, Pamphlet and French 302* (NBG, PRE); 26 Jul 1946, *Smith 46* (NBG); 04 Jul 1970, *Hall 3642* (NBG); 04 Jul 1970, *Hall 3642* (PRE); 30 Aug 2015, *Deacon 4596* (NBG); 3 miles (4.8 km) from Nieuwoudtville on Van Rhyn's Pass (–AC), 23 Aug 1950, *Maguire 270* (NBG); Lokenburg (–CA), 28 Jun 1968, *Acocks 23991* (PRE).

WESTERN CAPE: **3118 (Vanrhynsdorp)**: Gifberg (–DC), 14 Jul 1974, *Thompson 2083* (PRE). **3219 (Wuppertal)**: Pakhuis (–AA), 07 Sep 1953, *Esterhuysen 21735* (BOL); Cederberg, path between Pakhuis and Heuningvlei (–AA), 19 Oct 1945, *Esterhuysen 12051* (BOL); Pakhuisberge, 17 km from Clanwilliam (–AA), 25 Aug 1995, *Rodriguez, Oubina and Cruze 2086* (PRE); Boontjieskloof, N of Cedarberg (–AA), 03 Jun 1973, *Taylor 8469* (NBG); Cederberg Mountains, NW of Wuppertal (–AC), 18 Aug 2012, *Jardine 1812A* (NBG); Cederberg, plots near Sneeuberg (–AC), 04 Sep 1975, *Durand 54* (NBG); Cederberg State Forest, Hoogvertoon (–AC), 24 Jul 1983, *Hockey 1*, (PRE); Cederberg, Gonnafontein, Eastern plateau, S of main track near fence (–CB), 08 Jul 2000, *Pond UP 95* (NBG); boundary gate Breekkransfontein, Kromrivier (–CB), 22 Jun 1984, *Taylor 10960* (NBG, PRE); Swartruggens, 60 km NE of Ceres, Knolfontein (–DC), 24 Aug 2012, *Jardine 1812* (NBG); 30 Jul 2012, *Jardine 1801* (NBG); 26 May

2009, *Jardine 1122* (NBG); 20 Jun 2006, *Jardine and Jardine 319* (NBG); 19 Jul 2011, *Jardine 1568* (NBG); 20 Jun 2006, *Jardine and Jardine 682* (NBG); Swartruggens, Houtnekskloof Pass (–DC), 10 Jul 1991, *Van Zyl 4207* (NBG). **3319 (Worcester)**: Titus River at N of foot inner Sanddrif Peaks (–AB), 02 Jun 1974, *Oliver 4871* (NBG); De Doorns, N of the National Road through Verkeerdevlei (–BD), 13 Jun 1975, *Durand 27* (NBG). **3320 (Montagu)**: Matjiesfontein, near radiomast, top of Witterberge (–BC), without date, *Van Zyl 3566* (PRE); ± 10 km SE of Matjiesfontein, plateau SW of Ezelfontein (–BC), 13 May 2011, *Helme 7004* (NBG).

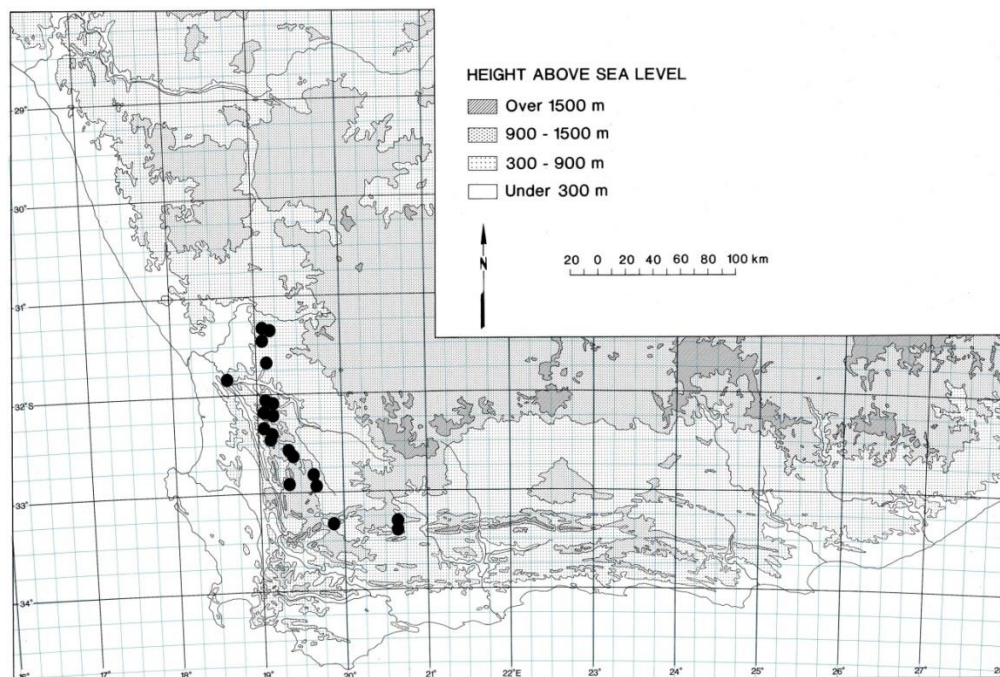


Figure 5.6: Known distribution of *O. hederifolia*.

6. ***Othonna intermedia*** Compton in J. S. African Bot. 15: 108 (1949). Type: South Africa, Western Cape, Van Rhynsdorp (3118): '20 miles [32 km] north of Van Rhynsdorp', (–DA), 18 Jul 1948, *Compton 20542* (NBG!, holo.; K—image!, iso.).

Deciduous geophyte, to 15 cm, with short subterranean stem branching shortly above ground level, branches erect to sub-erect; rootstock obovoid. *Leaves* crowded basally, spreading, base narrowed and petiole-like, blade obovate-spatulate to oblanceolate or cuneate, 30–75 × 10–40 mm, entire, leathery to succulent, glabrous, upper leaves sessile and sometimes clasping, 20–60 × 5–20 mm, uppermost leaves lanceolate to elliptic, 3–8 × 1–3 mm long. *Inflorescence* of one to two capitula, often with lateral axes; peduncles 30–120 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 8–12 mm diam., involucral bracts 8 to 10, lanceolate to elliptic, 8–10 × 2–4 mm. *Ray florets* 8 to 10, perianth tube 2.0–2.5 mm long, limb oblong, 3–5 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 3–5 × 2–3 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 3–5 mm long, beige. *Disc florets* numerous, perianth tube 1.0–1.5 mm long, lobes ovate, 0.8–1.0 mm long; filaments 1.6–2.0 mm long; ovary 1–3 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: endemic to southern Namaqualand, where it is most common on the Knersvlakte north of Vanrhynsdorp in Western Cape (Fig. 5.7); restricted to white-quartz patches at altitudes above 150 m. Flowering from June to September.

Diagnosis: *Othonna intermedia* is distinguished by its diminutive size, up to 15 cm high (Fig. 3.1C), and unique obovate-spatulate leaves.

Additional specimens examined

South Africa. WESTERN CAPE: **3118 (Vanryhnsdorp)**: Aurora (–AB), 12 Sep 1996, *Bruyns 6804* (BOL); Douse the Glim (–BB), 22 Sep 2015, *Manning and Magoswana 3535* (NBG); on Douse the Glim road, 24 km N of Vanrhynsdorp (–BB), 04 Aug 1977, *Le Roux 2056* (NBG); Knersvlakte (–BC), 24 Jul 1948, *Compton 20686* (NBG); 25 Jul 1941, *Compton 11125* (NBG); 03 Sep 1948, *Compton 20873* (NBG); 06 Sep 1950, *Barker 6605* (BOL, NBG, PRE); 26 Aug 1959, *Barker 9061* (NBG); Knersvlakte, Kwaggaskop (Quaggaskop) 215 along road to Douse the Glim between Sout Rivier [Salt River] and Ratelkop (–BC), 01 Sep 1997, *Paterson-Jones 809* (NBG); 27 Jun 2002, *Burgoyne s.n.* (PRE); 23 Aug 1941, *Esterhuysen 5669* (BOL); 25 Jul 1941, *Esterhuysen 5295* (BOL); Knersvlakte, Farm Vinkelshoek (–BC), 03 Aug 2012, *Koekemoer 4282* (PRE); Beeswater (–BC), 14 Aug 1988, *Bruyns 3320* (NBG); Knersvlakte, turn-off at Groot-Graafwater (–BC), 18 Aug 2015, *Manning and Magoswana 3524* (NBG); E of Knersvlakte, along road from Grootdrif towards Gembokrivier on the farm Elandsfootpath rivier (–BD), 19 Jul 2005, *Snijman 1987* (NBG); Koekenaap, 50 miles (80 km) E of Nuwerust (–CB), 05 Aug 1956, *Hall NBG 409/56* (NBG); about 20 km NW of Vanrhynsdorp, Varsche river (–DA), 26 Jul 2012, *Helme 7499* (NBG); Vanrhynsdorp (–DA), 22 Jul 1949, *Compton NBG 843/48* (NBG).

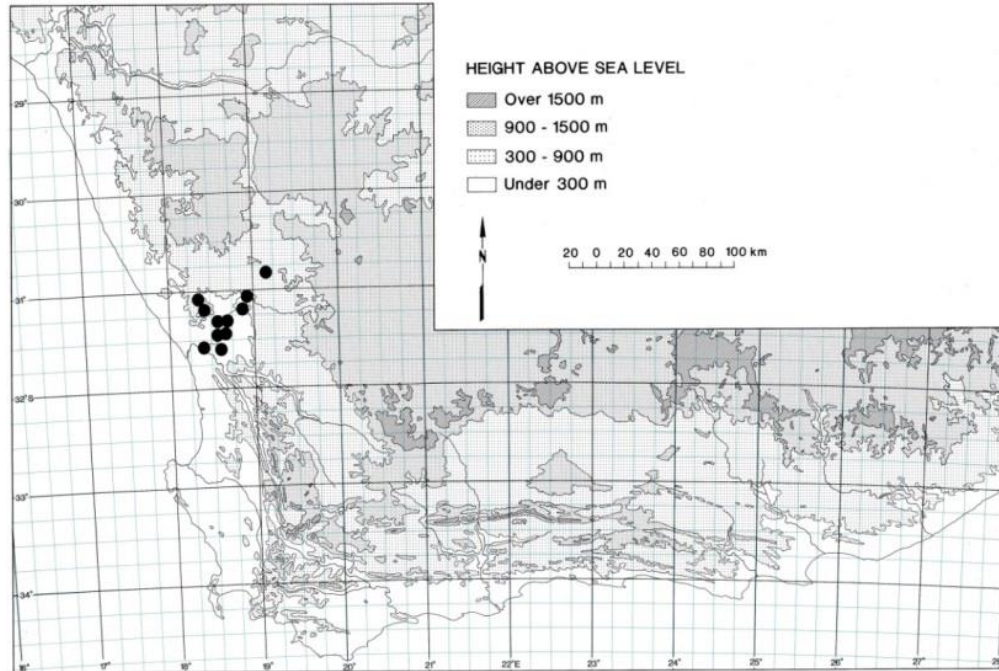


Figure 5.7: Known distribution of *O. intermedia*.

7. ***Othonna lyrata*** DC., Prodr. 6: 481 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 344 (1865). Type: South Africa, Western Cape, Clanwilliam (3218): 'Clanwilliam', (–BB), without date, *Ecklon 1349* (G-DC, lecto.—microfiche!, designated here). [Syntypes: South Africa, Western Cape, Clanwilliam (3218): 'in Africae Capensis district Clanwilliam locality 76', (–BB), without date, *Ecklon 878* (G-DC—microfiche!, syn.); South Africa, Western Cape, Worcester (3319): 'Worcester locality 69', (–CB), without date, *Ecklon [1781]* (G-DC—microfiche!, syn.). Note: *Ecklon 1349* is selected as lectotype as it is the most complete in vegetative and reproductive material.

Deciduous geophyte, to 60 cm, with short underground stem branching shortly above ground level, branches erect to flexuous; rootstock conical or oblong. Leaves crowded basally, spreading, conspicuously petiolate, blade suborbicular to cuneate,

lyrate, 60–200 × 40–180 mm, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 35–80 × 10–40 mm, uppermost leaves lanceolate to elliptic, 4–20 × 2–4 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 20–150 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 6–15 mm diam., involucral bracts 8 or 9, lanceolate to elliptic, 8–10 × 2.0–3.5 mm. *Ray florets* 8 or 9, perianth tube 2.0–3.5 mm long, limb lanceolate to elliptic, 10–12 × 3 mm; ovary obovoid, appressed-puberulous with twin-hairs; style branching below mouth of tube. *Cypselas* obovoid, 3.5–4.5 × 2.5 mm, densely appressed-puberulous on ribs with myxogenic white hairs; pappus 4–6 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes elliptic to lanceolate, 0.6–1.0 mm long; filaments 1–2 mm long; ovary 3–5 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: evidently a narrow endemic known from a few collections in the western mountains of Western Cape, from the Nardouwsberg to Pakhuis Pass (Fig. 5.8); on loamy slopes at altitudes above 200 m. Flowering from July to September.

Diagnosis: *Othonna lyrata* is recognised by its lyrate, petiolate basal leaves (Fig. 3.3C), and capitula with 8 or 9 involucral bracts and rays. *Othonna petiolaris*, also with 8 or 9 involucral bracts and rays, has oblong to ovate, lacerate leaves (Fig. 3.3D).

Additional specimens examined

South Africa. WESTERN CAPE: **3118 (Vanrynsdorp)**: Nardouw Road (–DD), 02 Sep 1945, *Compton 17145* (NBG). **3218 (Clanwilliam)**: 13 miles (21 km) from Clanwilliam

(–BB), 22 Aug 1950, *Barker 6424* (NBG). **3219 (Wuppertal)**: Alpha (–AA), 28 Jul 1963, *Barker 9909* (NBG); Niewoudt Pass (–AC), 29 Aug 2016, *Jakoet and Magee 50* (NBG).

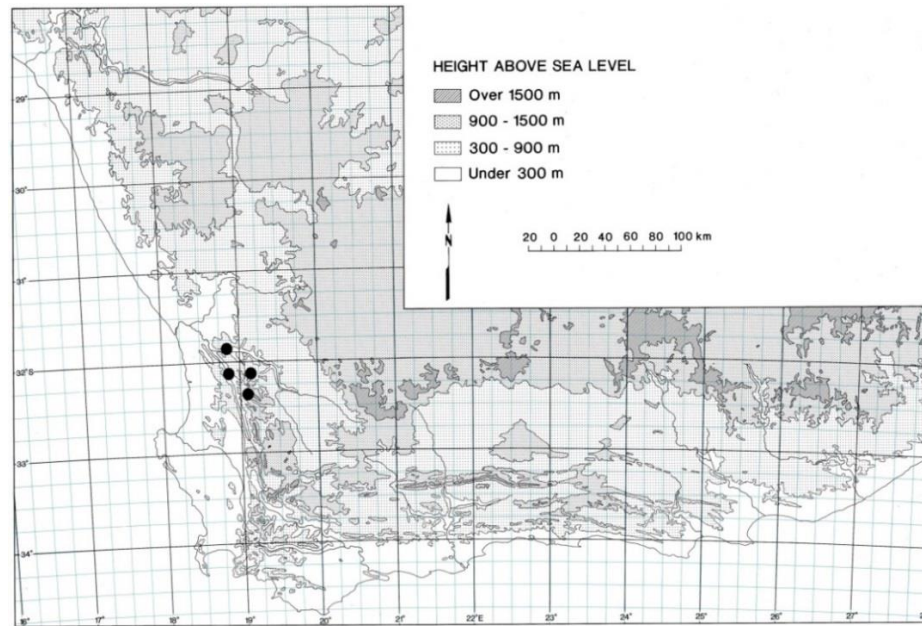


Figure 5.8: Known distribution of *O. lyrata*.

8. ***Othonna petiolaris*** DC., Prodr. 6: 480 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 343 (1865). Type: South Africa, [Northern Cape], ‘in Klein Namaqualand’ [Bei Mierenkasteel, (*Drège*, 1843)], without date, *Drège* [2870 pp.] G-DC, holo.—microfiche!, HAL—image!, K[000306999]— image!, SAM!, iso.).

Deciduous geophyte, to 50 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock conical or oblong. Leaves crowded basally, spreading, conspicuously petioled, blade oblong to ovate, 50–340 × 30–260 mm, lacerate, leathery to sub-succulent, glabrous, upper leaves sessile or

sometimes petiolate, 40–110 × 15–35 mm, uppermost leaves lanceolate to elliptic, 5–28 × 2–5 mm. *Inflorescence* of one to four capitula, sometimes with lateral axes; peduncles 10–200 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 8–15 mm diam., involucral bracts 8 or 9, lanceolate to elliptic, 6–10 × 1–2 mm. *Ray florets* 8 or 9, perianth tube 2–4 mm long, limb elliptic-ovate, 8–10 × 2–4 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 3–5 × 1–2 mm, densely appressed-puberulous on ribs with non-myxogenic white hairs; pappus 4–6 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes lanceolate to ovate, 0.6–1.0 mm long; filaments 1.5–2.5 mm long; ovary 3–5 mm long; style simple and cone tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: restricted to the near interior of the West Coast of Western Cape, from the Knersvlakte north of Vanrhynsdorp and the coastal mountains, from the Gifberg to the northern Cederberg (Fig. 5.9); on sandstone slopes above 200 m. Flowering from June to August.

Diagnosis: *Othonna petiolaris* is recognised by its large basal leaves, >300 mm long and distinctly petioled with lacerate blades (Fig. 3.3D), and the capitula in lax corymbs, with just 8 or 9 involucral bracts. Another large-leaved species, *Othonna macrophylla* from Namaqualand, has sessile leaves with denticulate margins, and capitula with 12 or 13 involucral bracts.

Additional specimens examined

South Africa. WESTERN CAPE: **3118 (Vanrhynsdorp):** 5 km NNE of Douse the Glim road 24 km N of Vanrhynsdorp (–DA), 04 Aug 1977, *Le Roux* 2053 (NBG); Gifberg (–

DC), 06 Sep 1994, *Van Zyl 4404* (NBG, PRE); Klawer (–DC), 21 Jun 1953, *Hall 725* (NBG); Heerenlogement (–DC), 21 Jul 1941, *Esterhuysen 5584* (BOL); 21 Jul 1941, *Compton 10983* (NBG); Nardouws plateau, Brakkenfontein (–DD), 03 Sep 2006, *Helme 4248* (NBG); Farm Nardouw, first farm on top of pass from Clanwilliam, 1 km N of farmhouse (–DD), 01 Jun 2016, *Koopman 1271* (NBG). **3218 (Clanwilliam):** Clanwilliam (–BA), 20 Jun 1941, *Compton 10974* (NBG); Olifants River Barrage (–BC), 23 Aug 1941, *Compton 11330* (NBG). **3219 (Wuppertal):** Pakhuis Pass, about 6 miles (10 km) from Clanwilliam (–AA), 03 Sep 1970, *Wisure 1740* (NBG); Middelpas, banks of Bidouw river, 3 miles (6 km) from Farm Bidouw, on way to Wuppertal (–AB), 08 Jul 1941, *Leipoldt 3643* (BOL); Brackfontein (–BC), 01 Jul 1896, *Schlechter 7980* (BOL).

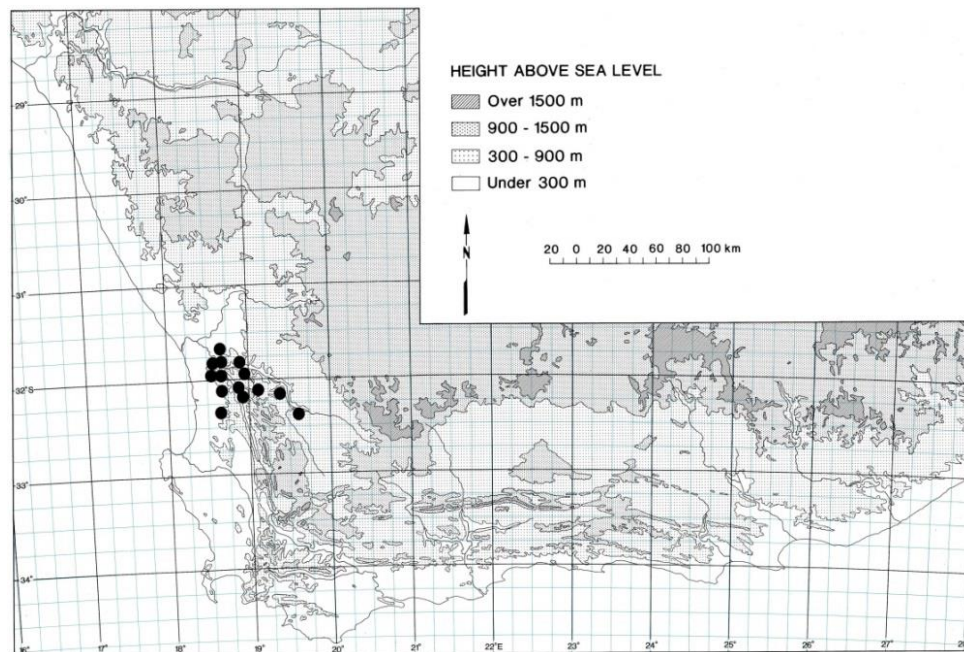


Figure 5.9: Known distribution of *O. petiolaris*.

9. ***Othonna rotundiloba*** DC., Prodr. 6: 481 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 344 (1865) [as '*O. rotundifolia*']. Type: South Africa, Western Cape: 'in Africae Capensis Klein Namaqualand [between Heerenlogementsberg and Knakkiesberg]', without date, *Drège* [2871] (G-DC, holo.—microfiche!).

Othonna sonchifolia DC., Prodr. 6: 482 (1838), nom. illeg., non *Othonna sonchifolia* L., Sp. Pl. 2: 924 (1753). Type: South Africa, Western Cape, Cape Town (3318): 'Africae Capensis distri. Stellenbosch', (–DD), without date, *Ecklon* [418] (G-DC, holo.—microfiche!; SAM!, iso.).

Othonna papaveroides Hutch. in Ann. S. African Mus. 9: 414 (1917), *syn. nov.* Type: South Africa, Western Cape, Vanrhynsdorp (3118): 'Giftberg', (–DC), Sep 1911, *Phillips* 7397 (K, lecto.—image!, designated here; SAM!, isolecto.). [Syntype: South Africa, Western Cape, Vanrhynsdorp (3118): 'Giftberg', (–DC), Sep 1911, *Phillips* 7654 (K—image!, *syn.*, BOL!, *isosyn.*)]. *Note*: Hutchinson (1917) cited two Phillips collections in his protologue. *Phillips* 7397 (K) is selected as lectotype as it is most complete and has a duplicate in SAM.

Deciduous geophyte, to 40 cm, with short subterranean stem branching shortly above ground level, branches sub-erect to flexuous; rootstock conical or oblong. Leaves crowded basally, spreading, conspicuously petioled, blade lanceolate, 60–210 × 15–75 mm, pinnatisect, lobes quadrate to rounded, leathery to sub-succulent, glabrous, sometimes with one or two upper leaves or lacking, uppermost leaves lanceolate, 2–5 × 1–2 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 10–220 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 10–20 mm diam.,

involucral bracts 7 to 9, oblong to lanceolate, 5–10 × 2–4 mm. *Ray florets* 7 or 8 (9), perianth tube 2–4 mm long, limb elliptic-ovate, 5–8 × 3–5 mm; ovary oblong, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong, 6–8 × 2–4 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 8–12 mm long, beige. *Disc florets* numerous, perianth tube 1.5–2.0 mm long, lobes lanceolate to elliptic, 0.8–1.5 mm long; filaments 2.0–2.5 long; ovary 5–7 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: distributed along the West Coast and near interior of South Africa, mostly from Vredendal south to Darling and Montagu in Western Cape and eastwards to Caledon Swartberg but with an isolated collection on the Bokkeveld Plateau at Kliprug southwest of Calvinia in the Northern Cape (Fig. 5.10); on sandy soils or granite outcrops above 600 m. Flowering from July to September.

Diagnosis: *Othonna rotundiloba* is characterised by its deeply pinnatisect leaves with quadrate lobes that are equally spaced along the axis (Fig. 3.3E), and solitary or few capitula with 8 or 9 involucral bracts and ray florets. *Othonna petiolaris* has pinnatifid leaves with the lobes not clearly separated, and capitula in lax corymbs.

Note: This species has been known until now under the illegitimate homonym *Othonna sonchifolia* DC. (eg. Manning & Goldblatt, 2012). Nomenclatural corrections necessary for *Othonna sonchifolia* DC. are implemented in Magoswana et al. (2017, Appendix 2). *Othonna papaveroides* Hutch. (1917), from the Gifberg, matches *O. rotundiloba* in its pinnatisect leaves with quadrate lobes and involucral bracts 7 or 8, and is relegated to synonymy.

Additional specimens examined

South Africa. NORTHERN CAPE: **3119 (Calvinia)**: Kliprug (–CB), 04 Jul 1994, *Bruyns* 6058 (BOL).

WESTERN CAPE: **3118 (Vanrhynsdorp)**: Farm “Kliphoek” about 15 miles (24 km) SW of Vredendal (–AD), 12 Aug 1970, *Hall* 3747 (NBG); Vredendal, 10 km SE of Doringbaai, Kliphoek 397 (–AD), 23 Jul 2006, *Helme* 4449 (NBG); Gifberg (–CB), 06 Sep 1994, *Van Zyl* 4403 (NBG); 13 km SW of Doringbaai towards Lamberts Bay (–CC), 10 Sep 1980, *Van Jaarsveld* 5698 (NBG); Nardouw (–DC), 06 Sep 1933, *Salter* 3654 (BOL). **3217 (Vredenburg)**: Vredenburg (–DD), 06 Jul 1962, *Barker* 9682a (NBG). **3218 (Clanwilliam)**: Langekloof (–BB), 05 Jul 1996, *Schlechter* 8032 (BOL, PRE); Boschkloof (–BB), 06 Aug 1896, *Schlechter* 8430 (BOL); Pakhuis Pass, on by-road past Soldaatkop (–BB), 07 Jul 1984, *Taylor* 10976 (NBG, PRE). **3318 (Cape Town)**: Ackers Farm, Langebaan (–AA), 25 Jul 1970, *Axelson* 255 (NBG); Hopefield (–AB), Sep 1912, *Kensit* s.n. (BOL); between Hopefield and Darling (–AB), 03 Sep 1944, *Leighton* 630 (BOL); between Mamre and Darling (–BC), 05 Aug 1940, *Bolus* s.n. (BOL); Darling Flora Reserve (–AD), 28 Jun 1956, *Rycroft* 1929 (NBG); Koperfontein (–DD), 03 Sep 1944, *Compton* 15963 (NBG). **3320 (Montagu)**: Hill about 5 miles (8 km) east of Montagu (–CC), Jul 1918, *Michell* 16164 (BOL). **3419 (Caledon)**: Swartberg (–AB), Jul 1892, *Guthrie* 2492 (BOL).

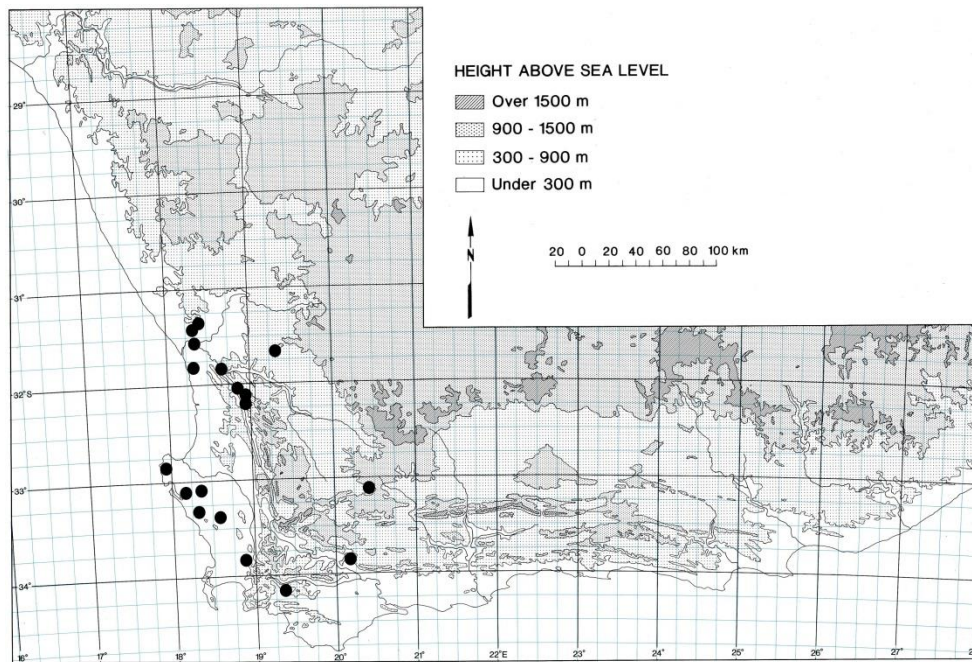


Figure 5.10: Known distribution of *O. rotundiloba*.

10. *Othonna macrophylla* DC., Prodr. 6: 480 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 343 (1865). Type: South Africa, [Northern Cape], 'in Africa ad Klein Namaqualand', (Drège, 1843), without date, Drège [2870 pp.] [2 sheets] (G-DC, holo.—image!; P [3 sheets]— [0004820] image!, iso.; HAL—image!, K—(000307000) image!, possible iso.).

Othonna ovalifolia Hutch. in Ann. S. African Mus. 9: 409 (1917), *syn. nov.* Type: South Africa, Western Cape, Kamiesberg (3018): Kamiesberg, among rocks near summit of Beacon Hill 2', (–AC), 15 Sep 1911, Pearson 6670 (K—image!, lecto., designated here; SAM!, isolecto.). [Note: We select the collection at K as lectotype as most likely representing the original material seen by Hutchinson whose herbarium and types are at K (Stafleu and Cowan, 1981)].

Deciduous geophyte, to 60 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect, glabrous in axils; rootstock oblong or turnip-shaped. *Leaves* crowded basally, erect to sub-erect, sessile, blade ovate-elliptic, 50–300 × 50–150 mm, sparsely denticulate or coarsely runcinate; leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 50–150 × 20–60 mm, uppermost leaves lanceolate to elliptic, 5–30 × 2–10 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 15–120 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 10–20 mm diam., involucral bracts 12 or 13, elliptic, 8–10 × 1–2 mm. *Ray florets* 12 or 13, perianth tube 3–5 mm long, limb lanceolate to elliptic, 6–8 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 4–7 × 1–2 mm, densely appressed-puberulous on ribs with non-myxogenic white hairs; pappus 5–7 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes lanceolate to ovate, 0.6–1 mm long; filaments 1.8–2.0 mm long; ovary 4.0–6.5 mm long; style simple and cone-tipped; pappus of ± 10 bristles united basally.

Distribution and ecology: restricted to the western escarpment of the Northern Cape, from the Richtersveld south to Nuwerus, at altitudes above 500 m (Fig. 5.11); on rocky granite slopes, usually on cooler slopes or sheltered among boulders. Flowering from July to September.

Diagnosis: *Othonna macrophylla* is recognised by its large, sessile leaves, 50–300 mm long, with denticulate or coarsely runcinate margins (Fig 3.3B) and capitula in lax corymbs, with 12 or 13 involucral bracts. *Othonna oleracea* from the Cederberg and adjacent mountains has large, petioled leaves (Fig. 3.3F), and ray florets with a

characteristically long perianth tube, 5–6 mm long. *Othonna petiolaris* from the Western Cape south of Nuwerus, has lacerate to lyrate, petioled leaves with sinuate margins (Fig. 3.3D), and just 8 or 9 involucre bracts.

Additional specimens examined

South Africa. NORTHERN CAPE: **2817 (Richtersveld)**: Vioolsdrif (–AC), 28 Aug 1925, *Marloth 12695* (PRE). **2917 (Springbok)**: Karrasberg (–AD), 16 Jun 1995, *Bruyns 6345* (BOL); Klipfonteinkop (–BA), 27 Aug 1935, *Compton 5429* (NBG); Steinkopf, 8 km W of Bulletrap (–BC), 13 Jul 2006, *Bruyns 10479* (NBG); 27 km W of Springbok (–DA), 04 Jul 1987, *Bruyns 2684* (NBG); top of Spektakel Pass (–DA), 24 Sep 2015, *Manning and Magoswana 3551* (NBG); W of Springbok, Naries guest Farm near view point (–DA), 22 Aug 2012, *Koekemoer 4333* (PRE); Spektakel (–DA), 25 Aug 1941, *Esterhuysen 5874* (BOL); 14 miles (23 km) W of Springbok (–DA), without date, *Acocks 19258* (PRE); Hester Malan Nature Reserve (–DB), 02 Jun 1985, *Struck 9* (NBG); Wildeperdehoek Pass (–DC), 09 Sep 1980, *Goldblatt 5753* (PRE). **3017 (Hondeklipbaai)**: Skilpad Wildflower Reserve (–BB), 04 Aug 1996, *Cruz 152* (NBG); 01 Sep 1956, *Barker 8630* (NBG); Kamieskroon, Skilpad Wildflower Reserve (–BB), 13 Jul 1993, *Funk and Koekemoer 12645* (PRE); ± 1 km N of Darter's grave between Garies and Kamieskroon (–BD), 23 Sep 2015, *Manning and Magoswana 3544* (NBG); Brakdam (–BD), 24 Jul 1941, *Esterhuysen 5438* (BOL); 03 Sep 1951, *Maguire 960* (NBG); 04 Sep 1945, *Compton 17912* (NBG); 24 Jul 1941, *Compton 11094* (NBG). **3018 (Kamiesberg)**: Eselsfontein (–AC), 05 Sep 1950, *Compton 22059* (NBG); Kamiesberg near Rooiberg (–AC), 10 Jun 1980, *Esterhuysen 35452* (BOL); Kamiesberg, Sneeuwkop (AC), 14 Oct

1928, *Hutchinson* 886 (BOL); Garies, Keurbos (–CB), 15 Jul 2006, *Bruyns* 10492 (NBG). **3117 (Lepelfontein)**: Toringberg, 27 km W of Bitterfontein, Louisfontein 44 (–BB), 18 Jun 2009, *Helme* 6340 (NBG); east of Katdoringvlei (–BB), 8 Sep 1994, *Bruyns* 6152 (BOL).

WESTERN CAPE: **3118 (Vanryhnsdorp)**: Kamkas (–AA), 11 Sep 1911, *Pearson* 6824 (BOL); 8 Sep 1994, *Bruyns* 6149 (BOL); Karee Berge (–AB), 21 Jul 1896, *Schlechter* 8250 (BOL); Garies (–AB), 24 Jul 1941, *Esterhuysen* 5428 (BOL); between Bitterfontein and Garies (–AB), 23 Jul 1941, *Esterhuysen s.n.* (BOL).

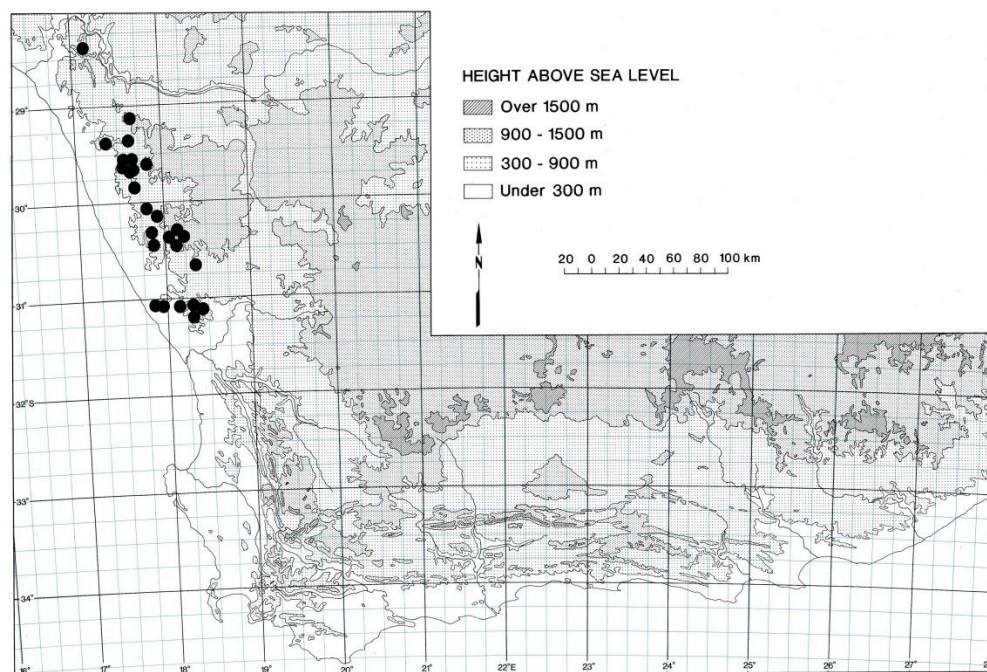


Figure 5.11: Known distribution of *O. macrophylla*.

11. ***Othonna oleracea*** Compton. in J. S. African Bot. 8: 268 (1942). Type: South Africa, Western Cape, Worcester (3319): 'Ceres, Karoo Poort', (–BC), 25 Aug 1935, *Compton* 6438, (NBG, holo.!, PRE—image!, iso.).

Deciduous geophyte, to 35 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock obconical. *Leaves* crowded basally, spreading, conspicuously petioled, blade obovate, 30–155 × 20–95 mm, entire or sometimes dentate to lobed, leathery to succulent, glabrous, upper leaves sessile and sometimes clasping, 15–40 × 5–20 mm, uppermost leaves lanceolate to elliptic, 5–15 × 1–5 mm. *Inflorescence* of one capitulum, sometimes with lateral axes; peduncles 15–250 mm long; glabrous. *Capitula* radiate, yellow. *Involucre* 10–20 mm diam., involucre bracts 12 or 13, elliptic, 8–12 × 2–4 mm. *Ray florets* 12 or 13, perianth tube 5–6 mm long, limb lanceolate to elliptic, 14–16 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with white hairs; style branching above mouth of tube. *Cypselas* oblong to obovoid, 4–7 × 2–4 mm, densely appressed-puberulous on ribs with non-myxogenic white hairs; pappus 7–10 mm long, beige. *Disc florets*, numerous, perianth tube 2.0–2.5 mm long, lobes lanceolate to ovate, 0.6–1.2 mm long; filaments 1.8–2.5 mm long; ovary 2–4 mm long; style simple and cone tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: restricted to the drier western mountains of Western Cape, from the Matsikamma through the eastern Cederberg to Karooport, at altitudes above 500 m (Fig. 5.12); on sheltered, stony slopes. Flowering from July to September.

Diagnosis: *Othonna oleracea* is recognised by its large, petiolate leaves with obovate blades up to 155 × 95 mm (Fig. 3.3F), and capitula with 12 or 13 involucre bracts and ray florets, the latter with characteristically long perianth tube, 5–6 mm long. The cauline leaves are glabrous in the axils. *Othonna petiolaris*, also with large, petiolate leaves, has capitula with just 8 or 9 involucre bracts and rays, and *O.*

macrophylla has sessile leaves. *Othonna oleracea* can also sometimes be confused with *O. bulbosa* but that species has smaller leaves up to 140 × 55 mm that are thinly cobwebbed in the axils.

Additional specimens examined

South Africa. WESTERN CAPE: **3118 (Vanrhynsdorp)**: between Klawer and Vanrhynsdorp, on roadside (–DC), 18 Aug 2015, *Manning and Magoswana* 3522 (NBG). **3219 (Wuppertal)**: Klipfonteinrand (–AA), 13 Sep 1947, *Barker* 4723 (NBG); Citadel Kop (–AA), 08 Sep 1953, *Compton* 24292 (NBG); road going from Wuppertal to Eselbank (–AC), 29 Sep 2007, *Ebrahim* CR2625 (NBG); along road to Wuppertal, ± 5 km N of Eselbank (–AC), 23 Jun 2016, *Koopman* 1275 (NBG); near Wuppertal to Clanwilliam (–AC), Oct 1900, *Bolus* 9034 (BOL); 6.2 miles (10 km) from turn-off from Clanwilliam/Calvinia road (–AC), 24 Aug 1967, *Thomson* 341 (NBG); Matjiesrivier Nature Reserve, Klein Kromrivier (–CB), 28 Aug 1999, *Low* 4660 (NBG). **3319 (Worcester)**: Karooport (–BC), 25 Aug 1935, *Compton* 6438 (NBG); 27 Jul 1941, *Compton* 11163 (NBG); 30 Jun 1940, *Compton* 8602 (NBG).

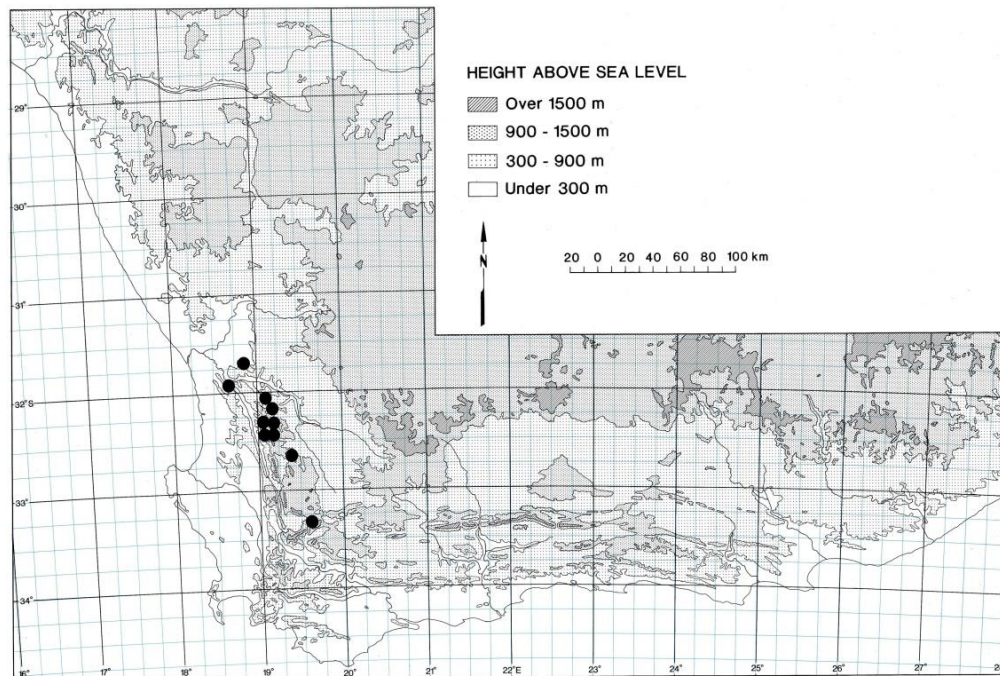


Figure 5.12: Known distribution of *O. oleracea*.

12. *Othonna pinnata* L.f., Suppl. Pl. 387 (1782). Type: South Africa, Western Cape, 'Cap. Bonae Spei', without date, *Thunberg s.n.* [UPS-THUNB 20890] (UPS-THUNB, holo.—microfiche!; SBT [2 sheets]—image!, iso.).

Othonna reticulata DC., Prodr. 6: 481 (1838), *syn. nov.* Type: South Africa, Western Cape, Clanwilliam (3218): 'in Africâ Capensi ad Clam Williams [Clanwilliam] propè flum. Elephantum', (–DB), [without date], *Ecklon* [1427, 1567] (G-DC—microfiche!, *syn.*).

Deciduous geophyte, to 40 cm, with short underground stem branching shortly above ground level, branches decumbent to sub-erect; rootstock turnip-shaped. Leaves crowded basally, erect to spreading, petioled, blade lanceolate to ovate, 15–115 × 10–80 mm, pinnatisect or rarely simple or trifid, sometimes within a single individual, lobes

elliptic to ovate, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 20–45 × 5–20 mm, uppermost leaves lanceolate to elliptic, 5–30 × 2–10 mm. *Inflorescence* of one or two capitula, sometimes with lateral axes; peduncles 15–200 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 8–15 mm diam., involucral bracts 8 to 13, oblanceolate to elliptic, 8–10 × 2–3 mm. *Ray florets* 8 to 13, perianth tube 2–4 mm long, limb elliptic-ovate, 6–8 × 2–4 mm; ovary oblanceolate, appressed-puberulous with twin hairs; style branching shortly below mouth of tube. *Cypselas* obovoid, 3–5 × 1.5–2.0 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 5.0–6.5 mm long, beige. *Disc florets* numerous, perianth tube 1.0–1.5 mm long, lobes ovate, 0.5–1.0 mm long; filaments 1.5–2.0 × 0.2 mm long; ovary 3–5 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: distributed along the West Coast and near-interior of Western Cape, from the Cederberg to the Cape Peninsula and Worcester (Fig. 5.13); on sandy flats and gentle slopes, often in seasonally wet areas. Flowering from June to September.

Diagnosis: *Othonna pinnata* is distinguished by the pinnatisect or rarely simple or trifid, lanceolate to ovate leaves, sometimes within a single individual (Fig. 3.3J1–J2), inflorescence of one or two heads, with 8 to 13 involucral bracts each. In its habit and foliage the species resembles *O. tephrosioides*, a species with similar pinnatisect or rarely simple or trifid, lanceolate to ovate leaves, and an inflorescence with up to three heads but with only 7 to 10 involucral bracts. The leaves in *O. tephrosioides* may also be larger, 40–160 mm long vs 15–115 mm long. *Othonna tephrosioides* is only known

from only three collections and its taxonomic status is uncertain (see further discussion under this species).

Additional specimens examined

South Africa. WESTERN CAPE: **3218 (Clanwilliam)**: Slang Kop (–AD), Jun 1940, *Compton 8210* (NBG); Piketberg (–BC), 19 Jul 1941, *Compton 10902* (NBG, PRE); SE end of Piketberg Mountains (–DA), 28 May 1952, *Esterhuysen 20147* (BOL); W Slopes of Zebra Kop (–DB), 23 May 1948, *Esterhuysen 14497* (BOL, PRE); Citrusdal, Warm Baths (–DB), Jul 1915, *Bolus s.n.* (NBG, PRE); Versveld Pass (–DD), 17 Jul 1941, *Esterhuysen 5509* (BOL). **3219 (Wuppertal)**: Vredelus (–CC), 02 Sep 1962, *Esterhuysen 29686* (BOL); Waboomsrivier, Koue-Bokkeveld (–CD), 06 Sep 1966, *Hanekom 629* (PRE). **3318 (Cape Town)**: Klein Swartfontein, Moorreesburg (–BA), 25 Aug 1970, *Acocks 24317* (PRE); Cape Town (–CD), Sep 1881, *Tyson 2332* (NBG, PRE); Green Point (–CD), Jul 1846, *Prior s.n.* (PRE); Lion's Rump (–CD), Jul 1897, *Thode 5876* (NBG, PRE); Camps Bay (–CD), 06 Jul 1946, *Strey 926* (PRE); 24 Jun 1949, *Morris 124* (NBG, PRE); 14 Jul 1918, *Pillans s.n.* (PRE); Jul 1918, *Flanagan s.n.* (PRE); Aug 1906, *Marloth 6357* (PRE); 14 Jun 1946, *Barker 4028* (NBG, PRE); 14 Jun 1946, *Esterhuysen 12850* (PRE); upper western slopes of Lion's Head (–CD), 27 Jun 1915, *Pillans s.n.* (BOL); Dassenberg (–CD), Sep 1933, *Pillans 6862* (BOL); Sea Point (–CD), Aug 1899, *Bolus s.n.* (BOL); 31 Jul 1926, *Smith 2897* (PRE); Green Point (–CD), Jul 1846, *Alexander and Prior s.n.* (PRE); Milnerton (–CD), 29 Jun 1942, *Barker 1449* (NBG, PRE); between Salt River and Kalabaskraal, 11 miles (18 km) from Cape Town (–DA), 04 Sep 1928, *Hutchinson 157* (BOL, PRE); Paardeberg, between Wellington and

Malmesbury, Vlakfontein ± 400 m S of the Perdeberg Dam (–DB), Nicolson and Roets 167 (NBG); road going up Paardeberg on Farm Modderkloof (–DB), 17 Jun 1981, *Hugo* 2618 (NBG, PRE); Vissershoeek, (–DC), 21 Jul 1946, *Leighton* 1794 (BOL); Stellenbosch, SW Cape former Golf Course (–DD), 24 Apr 1963, *Bos* 97 (PRE). **3319 (Worcester):** S of Tulbagh Road Station (–AC), 11 Aug 1974, *Goldblatt* 2312 (PRE); Elandsberg Private Nature Reserve (–AC), 17 Jun 2000, *Parker* 461 (NBG); 10 Aug 2015, *Manning and Magoswana* 3510, 3511 (NBG); Skilpadrug (–AC), 17 Jun 1990, *Bruyns* 4337 (BOL); Ezelfontein (–AD), 01 Sep 1952, *Esterhuysen* 20339 (BOL, PRE); flats NW of Prince Alfred's Hamlet (–AD), 27 Jul 1974, *Oliver* 4974 (NBG, PRE); Ceres, Wolvenhuis 371 Schoonvlei Industrial Area, 4 km outside Ceres (–AD), 20 Aug 1987, *Cloete and Cillie* 62 (NBG); Karroo Poort (–AD), Aug 1930, *Bolus s.n.* (BOL); Tafelberg (–BB), 14 Aug 1955, *Esterhuysen* 24399 (BOL); Elands Kloof (–BB), 09 Sep 1945, *Leighton* 1279 (BOL); Bainskloof near Sabastians Kloof (–CA), 25 May 1940, *Esterhuysen* 1986 (PRE); Karoo Garden Veld (–CB), 25 Jul 1977, *Bayer* 888 (NBG); Worcester (–CB), 11 May 1947, *Compton* 19500 (NBG, PRE); Brandvlei Kop (–CB), 02 Jun 1940, *Compton* 8847 (NBG, PRE); 02 Jun 1986, *Esterhuysen* 1931 (BOL, PRE). **3418 (Simonstown):** Llandudno (–AB), 26 Jun 1940, *Compton* 8891 (NBG).

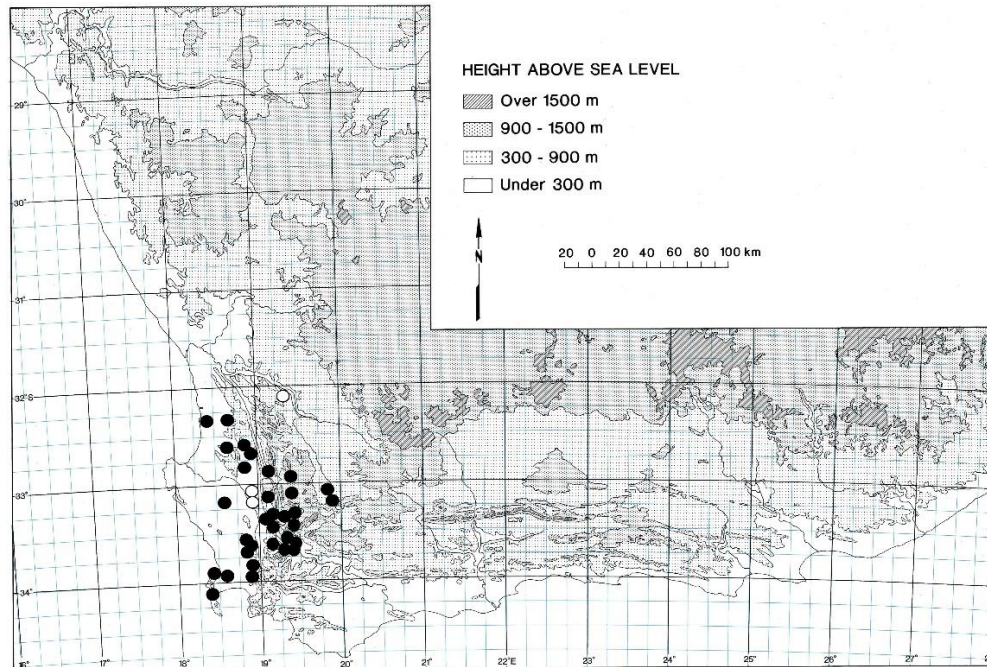


Figure 5.13: Known distribution of *O. pinnata* (●) and *O. tephrosioides* (○).

13. ***Othonna tephrosioides*** Sond. in Harv. and Sond., Fl. Cap. 3: 344 (1865). Type: South Africa, Western Cape, Wuppertal (3219): ‘Matjiesfontein’, (–AB), without date, Zeyher 999 (SAM!, lecto., designated here; BOL!, BM—image!, K—image!, isolecto.).
Note: We select as lectotype the collection at SAM as the most complete, including vegetative and reproductive material.

Deciduous geophyte, to 40 cm, with short underground stem branching shortly above ground level, branches decumbent to sub-erect; rootstock turnip-shaped. *Leaves* crowded basally, erect to spreading, petioled, blade lanceolate to ovate, 40–160 × 10–60 mm, pinnatisect or rarely simple or trifid; lobes lanceolate to oblanceolate or linear, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 20–60 × 10–30 mm, uppermost leaves lanceolate to linear, 4–20 × 1–4 mm. *Inflorescence*

of one to three capitula, sometimes with lateral axes; peduncles 10–60 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 8–15 mm diam., involucral bracts 7 to 10, oblanceolate to elliptic, 6–8 × 1–3 mm. *Ray florets* 7 or 8, perianth tube 2–3 mm long, limb elliptic-ovate, 5–9 × 2–3 mm; ovary oblong to oblanceolate, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to oblanceolate, 4–6 × 1–2 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 2–5 mm long, beige. *Disc florets* numerous, perianth tube 0.9–1.5 mm long, lobes lanceolate to ovate, 0.4–0.8 mm long; filaments 1.0–1.6 mm long; ovary 1.5–2.0 mm long, glabrous; style simple and cone tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: a poorly collected species known with certainty from between Piketberg and Porterville, and eastern Cederberg in Western Cape. The type locality Matjiesfontein refers to the farm of that name in the eastern Cederberg (Fig. 5.13); on seasonally wet gravelly flats. Flowering from July to September.

Diagnosis: *Othonna tephrosioides* is distinguished by its pinnatisect or rarely simple or trifid, lanceolate to ovate leaves, capitula with 7 to 10 involucral bracts and an inflorescence of up to three capitula. *Othonna tephrosioides* can be confused with *O. pinnata* with which it shares pinnatisect or rarely simple or trifid, lanceolate to ovate leaves but can be distinguished by the fewer involucral bracts, 7 to 10, an inflorescence of up to three capitula versus an inflorescence of one or two capitula and involucral bracts 8 to 13 in *O. pinnata*.

This species is vegetatively indistinguishable from *O. pinnata* and it is possible that they are not distinct as we are unable to see any differences between them except the much

branched inflorescence with up to three heads in *O. tephrosioides* and a tendency for slightly more involucre bracts. Until the situation is fully investigated we continue to treat them as distinct.

Additional specimens examined

South Africa. WESTERN CAPE: **3318 (Cape Town)**: Porterville (–BB), 20 Aug 1894, *Schlechter* 4896 (BOL); near Piketberg (–BB), 30 Jul 1937, *Marloth* 1227/37 (BOL, NBG).

14. ***Othonna stenophylla*** Levyns in J. S. African Bot. 7: 143 (1941), as nom. nov. pro. *O. linifolia* L.f., Suppl. Pl.: 388 (1782), nom. illeg., non *O. linifolia* Burm. f., Prodr. Fl. Cap.: 29 (1768). Type: South Africa, Western Cape: ‘Cape Bonae Spei’, [without date], *Thunberg* s.n. [33] (LINN [HL1038-18], lecto.—image!, designated here; SBT—image!, isolecto.). [Note: We select as lectotype the collection at LINN as most likely representing the original material seen by Linnaeus f., whose herbarium is partly at LINN (Stafleu and Cowan, 1981)].

[*Othonna linifolia* var. *laminata* Schltr. ms: *Schlechter* 7848, (HBG—image!, K—image!, PH—image!), *Harvey* s.n. (TCD—image!)].

Deciduous geophyte, to 40 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock turnip-shaped. Leaves crowded basally, erect to spreading, conspicuously petioled, petiole wiry, blade ovate to linear, 20–110 × 2–10 mm, entire, leathery to sub-succulent, glabrous, upper leaves sessile or sometimes petiolate, 15–90 × 2–4 mm, uppermost leaves narrowly elliptic to linear, 3–20 × 1–3 mm. *Inflorescence* of one to two capitula, sometimes with lateral

axes; peduncles 40–190 mm long, glabrous. *Capitula* radiate, yellow. *Involucre* 5–10 mm diam., involucre bracts 8 or 9, lanceolate to elliptic, 5–7 × 2–3 mm. *Ray florets* 8 or 9, perianth tube 2–3 mm long, limb elliptic-ovate, 8.5–9.5 × 1.5–2.0 mm; ovary oblanceolate to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* obovoid, 3–5 × 1–2 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 3–4 mm long, beige. *Disc florets* numerous, perianth tube 0.9–1.5 mm long, lobes ovate, 0.5–1.0 mm long; filaments 1.0–1.5 mm long, ovary 2–4 mm long; style simple and conned-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: common along the coastal plain of the Western Cape from Porterville to the Cape Peninsula and Cape Flats, extending into the upper Breede River Valley to Worcester, with additional collections from the southern coast near Bredasdorp and south of Riversdale; on damp sandy flats and shallow seasonal marshes (Fig. 5.14). Flowering from May to September.

Diagnosis: *Othonna stenophylla* is readily recognised by the linear to ovate leaves with long, wiry petioles, and small, radiate heads, the involucre 5–10 mm diam., with 8 or 9 involuicral bracts. *Othonna linearifolia* from sandy coastal flats, also with linear or linear-lanceolate leaves, has disciform capitula.

Additional specimens examined

South Africa. WESTERN CAPE: **3318 (Cape Town)**: 4 km N of Hopefield at Otterhoek along Soutrivier [Salt River] (–AB), 27 Jul 2002, *Helme* 2482 (NBG); Yzerfontein (–AC), 12 Sep 1945, *Compton* 17380 (NBG); Darling Flora Reserve (–AD), 24 May 1956,

Winkler 95 (NBG); 25 Jun 1956, *Winkler 102* (NBG); Rondeberg farm (–AD), Jul 2000, *Manning s.n.* (NBG); Mamre Hills (–BC), 22 Sep 1942, *Compton 13760* (NBG); Riverlands (–BC), 09 Sep 1983, *Esterhuysen 36057* (BOL), 08 Sep 1990, *Bruyns 4358* (BOL); Mamre Road (–BC), 31 Aug 1944, *Leighton 569* (BOL, PRE); 2 km E of Mamre Road Station (–BC), 14 Jul 1976, *Goldblatt 3569* (PRE); Kenilworth near Cape Town (–CD), Aug 1894, *Bolus 3256* (PRE), Aug 1896, *Bolus 7950* (BOL); Kenilworth Racecourse (–CD), 05 Jul 1903, *Phillips 188* (NBG); 01 Jul 1941, *Bond 1233* (NBG); Cape Flats near Raapenberg (–CD), 06 Jun 1890, *Guthrie 536* (BOL); Cape Flats (–CD), without date, *Bolus 3256* (BOL); Cape Town (–CD), Jun 1882, *Bolus 114* (BOL); between Kraaifontein and Durbanville (–CD), 01 Jun 1942, *Bolus s.n.* (BOL); 25 miles (40 km) from Cape Town along the Malmesbury Road (–CD), Aug 1932, *Lavis s.n.* (BOL); western edge of Dassenberg (–DA), 28 Jun 1979, *Boucher 4384* (PRE); Klipfontein, Malmesbury (–DC), 16 Sep 1982, *Van Zyl 3244* (PRE); Doornhoogte (–DC), without date, *Zeyher 3042* (PRE); flats near Rondebosch (–DC), 07 Aug 1895, *Flanagan 212* (PRE); Klipfontein, Malmesbury (–DC), 16 Sep 1982, *Van Zyl 3244* (NBG); between Kraaifontein and Durbanville (–DC), 14 Jun 1942, *Bolus s.n.* (NBG); near Groenfontein, Klapmuts (–DC), 15 Sep 1983, *Van Zyl 3491* (NBG, PRE). **3319**
(Worcester): Piketberg Road (–AC), 21 Jun 1896, *Schlechter 7848* (PRE); Elandsberg Nature Reserve, middle road (–AC), 10 Aug 2015, *Manning and Magoswana 3512* (NBG); 3 km NW of Tulbagh (–AC), 19 Aug 1998, *Bruyns 4340* (BOL); Worcester Commonage (–CB), 30 Aug 1985, *Bayer 4856* (NBG); near Worcester (–CB), 04 Aug 1949, *Steyn 201* (NBG). **3418 (Simonstown):** Muizenberg (–AB), 06 Jul 1924, *Levyens s.n.* (BOL); flats near Retreat (–AB), 30 Jul 1918, *Pillans 3119* (PRE); Steenberg (–AB),

30 Jun 1918, *Pillans 3119* (BOL); Fishhoek (–AB), Jun 1920, *Page 16523* (BOL); Cape Flats (–BA), without date, *Marloth 8659* (PRE); Wynberg Flats (–BA), 14 Jan 1847, *Prior s.n.* (PRE); Strand to Gordon's Bay (–BB), 31 Jul 1948, *Parker 4330* (NBG); Fish Hoek road at Kommetjie turning (–BB), 10 Jun 1947, *Barker 4581* (NBG). **3420**

(Bredarsdorp): Rietfontein (–CA), 11 Aug 1983, *Esterhuysen 36016* (PRE). **3421**

(Riversdale): Brandfontein (–DD), 10 Aug 1983, *Esterhuysen 35978* (BOL, PRE).

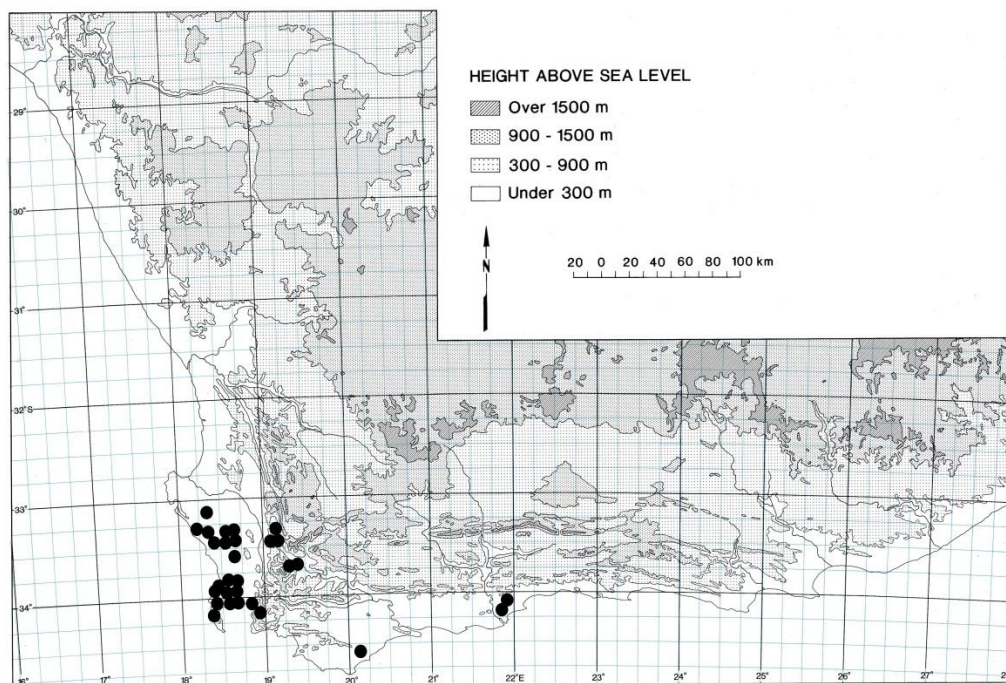


Figure 5.14: Known distribution of *O. stenophylla*.

Ser. *Perfoliatae* Magoswana and J.C. Manning, ser. nov.

Type: *O. perfoliata* (L.f.) Jacq.

Deciduous geophytes with short above ground stem sparsely branched in upper half, scandent or sometimes erect; capitula radiate or disciform with yellow, sometimes white florets; pappus bristles 4–20 mm long, beige, sometimes with red to dark red bands.

15. ***Othonna perfoliata*** (L.f.) Jacq., Pl. Rar. Hort. Schoenbr. 2: 61, t. 240 (1797).

Cineraria perfoliata L.f., Suppl. Pl.: 375 (1782). *Doria perfoliata* (L.f.) Thunb., Nov. Gen. Pl. 12: 164 (1800). *Othonna perfoliata* (L.f.) Sch. Bip. in Flora 27(2): 769 (1844), illegit. superfl. name. Type: South Africa, without locality or date, *Thunberg s.n.* (LINN1000.32, lecto., designated by Manning and Goldblatt, 2010: 39).

Othonna filicaulis Jacq., Pl. Rar. Hort. Schoenbr. 2: 62, t. 241 (1797). Type: illustration in Jacq., Pl. Rar. Hort. Schoenbr. 2: 62, t. 241 (1797), lecto., designated by Manning and Goldblatt, 2010: 39). Epitype, designated here: South Africa, Western Cape, Michell's Pass, below Rooi Kraans Peak, 02 August 1967, *Rourke 792* (NBG, epi.).

Othonna amplexifolia DC. Prodr. 6: 480 (1838). Type: South Africa, [Western Cape], Paarl, [31 August 1827], *Drège* [6063] (G-DC–microfiche!, holo.; HAL–image!, K–image!, P–image!, iso.).

Deciduous geophyte, to 70 cm, with short aboveground stem sparsely branched in upper half, straggling or sprawling among vegetation; rootstock obovoid or turnip-shaped. *Leaves* cauline, evenly scattered along above ground part of stem, base of stem leafless, sessile, spreading, clasping, blade lanceolate to ovate, 10–120 × 4–80 mm, entire, sometimes undulate, leathery to sub-succulent, glabrous, upper leaves 10–55 × 5–40 mm, uppermost lanceolate to linear, 5–40 × 2–30 mm. *Inflorescence* of one to two capitula; sometimes with lateral axes; peduncles 15–140 mm long, usually glabrous but sometimes puberulous in basal half. *Capitula* radiate, yellow. *Involucre* 10–30 mm diam., involucral bracts 8 or 9, lanceolate to elliptic, 7–9 × 2–4 mm. *Ray florets* 8

or 9, perianth tube 2–4 mm long, limb elliptic-ovate, 7–9 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly above mouth of tube. *Cypselas* oblong to obovoid, 2–5 × 0.5–2.0 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 4–8 mm long, beige. *Disc florets* numerous, perianth tube 2–4 mm long, lobes ovate, 0.5–1.0 mm long; filaments 1–2 mm long; ovary, 2–4 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: relatively widely distributed through the extreme southwestern part of Western Cape, from southern Namaqualand and the Bokkeveld Escarpment along the west coast inland to near Matjiesfontein (Fig. 5.15); on sandstone flats and slopes at altitudes below 1 000 m.

Diagnosis: *Othonna perfoliata* is vegetatively similar to *O. undulosa*, sharing with it the characteristic scandent habit and sessile, amplexicaul leaves but is readily distinguished by the radiate capitula with fewer involucre bracts, 8 or 9 versus 10 or 12, and cypselas with shorter pappus, 4–8 mm long. *Othonna rufibarbis* has erect to sub-erect branches, radiate capitula with 12 or 13 involucre bracts, and cypselas with a dark red pappus 5–10 mm long.

Note: Confusion as to application of the name *Othonna perfoliata* began with Linnaeus f. (1782), who in his protologue of *Cineraria perfoliata* cited two specimens housed in the LINN herbarium with different capitula, one radiate and the other disciform, but made no mention of the capitulum condition in his description. Jacquin (1797)

subsequently applied the name to a flowering plant with conspicuously radiate capitula and described a second and similar taxon under the name *Othonna filicaulis*, describing the capitula of this species as radiate but illustrating a plant with evidently disciform capitula, accompanied by a detailed drawing of a detached and clearly radiate peripheral floret. Later authors, misled by the illustration of the whole plant, applied the name *O. filicaulis* to disciform plants despite the clear reference to the radiate condition in the protologue description and in the detail of a detached ray floret. Manning and Goldblatt (2010) restored the application of the name to the radiate taxon and we designate an epitype here to fix this application. The disciform taxon is correctly known as *O. undulosa*.

Additional specimens examined

South Africa. NORTHERN CAPE: **3017 (Hondeklipbaai)**: 4 km NW of Sandkraal farmhouse, 15 km SE of Koopskop, Farm Zandkraal 434, on Bitterivier (–DC), 26 Jul 2007, *Helme and Koopman* 4742 (NBG). **3119 (Calvinia)**: Cloudskraal (–AB), 06 Jun 1929, *Mostert* 2162/27 (BOL); Oorlogskloof Nature Reserve, 15 km SSW of Nieuwoudtville, Grid E13 (–AC), 06 Jun 1995, *Pretorius* 245 (NBG); Skerpioensberg (–BB), 29 Jun 1956, *Taylor* 1649 (NBG).

WESTERN CAPE: **3118 (Vanrhynsdorp)**: Knersvlakte, Rooiberg (–AB), 18 Aug 1999, *Desmet* 23 (NBG); Matsikammaberg W of Sewefontein (–DB), 12 Jul 1974, *Thompson* 2054 (NBG). **3218 (Clanwilliam)**: Bulshoek Barrage, Olifants River (–BB), 22 Aug 1950, *Middlemost* 1590 (NBG); Olifants River valley near Bulshoek (–CB), 02 Aug 1999, *Goldblatt and Manning* 11082 (NBG); Olifants River (–DA), 16 Apr 1949, *Esterhuysen* 17561 (BOL); top of Piketberg (–DA), 25 Sep 1949, *Martin* 242 (NBG); 12

Sep 1951, *Martin* 864 (NBG); Piketberg plateau (–DA), 27 Jul 1963, *Thompson* 763 (NBG); [Citrusdal], Warm baths (–DB), 08 Jul 1935, *Compton* 5374 (NBG); Kaptein's Kloof (–DC), 05 Sep 1955, *Van Niekerk s.n.* (BOL). **3219 (Wuppertal):** Pakhuis (–AA), 23 Aug 1941, *Esterhuysen* 5917 (BOL); upper slopes of Suurvlaak-se-kop next to Venterberg (–AA), 23 Jun 1984, *Taylor* 10970 (NBG); N of Cederberg, rock edge E of Kliphuis Peak (–AA), 28 Sep 1983, *Taylor* 10710 (NBG); Niewoudt Pass (–AC), 13 Aug 1969, *Barker* 9896 (NBG); Wuppertal, NW of village (–AC), 06 Jun 1973, *Taylor* 8498 (NBG); Cederberg Mountains (–AC), 25 Jun 1942, *Esterhuysen* 7911 (BOL); Dwarsrivierberg (–CA), 02 Jun 1984, *Taylor* 10932 (NBG); Gonnafontein (–CB), 23 May 2000, *Pond UP77* (NBG). **3318 (Cape Town):** Camps Bay (–CD), Aug 1897, *Thode* 5875 (NBG); Paardeberg, Theronskloof, ± 700 m. N of base of kloof (–DB), 27 Jun 2011, *Nicolson and Roets* 127 (NBG); Paardeberg (–DB), 05 Aug 1935, *Pillans* 7647 (BOL); Kanonkop summit (–DD), 16 Oct 1977, *Taylor* 9711 (NBG); Jonkershoek, Stellenbosch (–DD), 26 Jun 1965, *Kerfoot K5200* (NBG). **3319 (Worcester):** Saron (–AA), 23 Jun 1896, *Schlechter* 7883 (BOL); Inkruip, Witzenberg (–AA), 01 Oct 1954, *Esterhuysen* 23482 (BOL); Tulbagh Road (–AC), May 1893, *Guthrie* 3039 (BOL); Tulbagh Waterfall (–AC), 16 Sep 1928, *Hutchinson* 390 (BOL); Elandskloof (–AC), 03 Oct 1940, *Compton* 9683 (BOL, NBG); Ezelsfontein (–AD), 01 Sep 1952, *Esterhuysen* 20360 (BOL); Ceres (–AD), Aug 1925, *Marloth* 12198 (PRE); Ceres Nature Reserve (–AD), 13 Sep 2000, *Koekemoer and Funk s.n.* (PRE); on side of national road (N1) (–BB), 18 Aug 2015, *Manning and Magoswana* 3529 (NBG); Witte River Valley (–CA), 02 Jun 1946, *Esterhuysen* 12819 (BOL); Bainskloof (–CA), Jul 1940, *Keis* 48 (NBG); 06 Sep 1967, *Marsh* 4 (NBG); 12 Jul 1948, *Compton* 18004 (NBG); 29 May 1946, *Leighton*

1697 (BOL, NBG), 29 May 1946, *Fairall NBG 474/39* (NBG); 14 Sep 1928, *Gillett 137* (NBG); Wolwenkloofbos Reserve (–CA), 08 Jun 1969, *Stehle TS262* (NBG); Rawsonville, “Gevonden” farm stall, (–CA), 28 Jul 1962, *Walters 659* (NBG); 25 May 1940, *Esterhuysen 1985* (BOL); Audensberg (–CB), 09 May 1954, *Esterhuysen 22905* (BOL); Haalhoek, Sneeuwkop (–CC), 24 May 1953, *Esterhuysen 21400* (BOL); Bergriver (–CC), Jun 1915, *Du Plessis 229/14* (BOL); Du Toit’s Kloof (–CC), 20 Aug 1953, *Compton 24121* (NBG); Karoo National Botanical Gardens (–CD), 30 Jun 1958, *Willemse 8* (NBG); Stettynsberg (–CD), 31 Jul 1949, *Esterhuysen 15591* (BOL); Hex River (–DA), 21 Jun 1953, *Esterhuysen 21587* (BOL); Doringkloof farm, southern foothills of Voetpadsberg (–DA), 08 Jun 1985, *Van Wyk 2373* (NBG). **3320 (Montagu):** Tweeside 151, S of railway line (–AD), 10 Aug 1988, *Le Roux 3707* (NBG); Cogman’s Kloof (–CC), 05 May 1949, *Morris 176* (BOL, NBG); 04 Jul 1938, *Levyms 6450* (BOL); Montagu (–CC), Jul 1942, *Levyms 8925* (BOL). **3321 (Ladismith):** Ladismith (–AD), 02 May 1965, *Bayliss 2816* (NBG); Noukloof Nature Reserve (–DB), 08 Jul 1982, *Laidler 89* (NBG). **3418 (Simonstown):** Witsand (–AB), 05 Oct 1992, *Daines 1398* (NBG); Panaroma (–BB), 04 Jul 1976, *Neethling s.n.* (NBG).

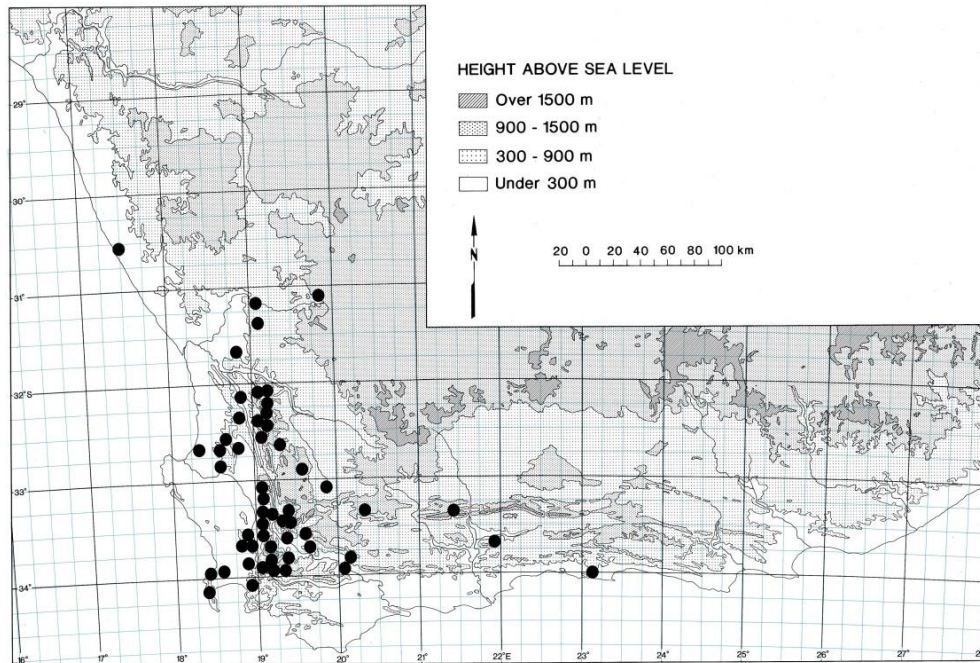


Figure 5.15: Known distribution of *O. perfoliata*.

16. ***Othonna rufibarbis*** Harv. in Harv. and Sond. Fl. Cap. 3: 341 (1865). Type: South Africa, Eastern Cape, Port Elizabeth (3325), 'Hills at Addo, Uitenhage', (–BD), without date, *Zeyher 3041* (K [K000307005]—image!, lecto., designated here; P—image!, S—image!, SAM!, isolecto.). *Note*: We select the collection at K as lectotype as it is the one most likely to have been seen by Harvey with the original collection details in his hand. The collection matches the description by Harvey, describing the basal leaves on long petioles and pubescent cypselas with a deep-red pappus.

Deciduous geophyte, to 40 cm, with short aboveground stem sparsely branched in upper half, branches erect to sub-erect; rootstock obovoid to turnip-shaped. Leaves cauline, sparse above, spreading, sessile, clasping, blade elliptic to oblanceolate or ovate, 30–70 × 10–30 mm, entire or undulate, leathery to sub-succulent, glabrous,

upper leaves 15–50 × 10–30 mm, uppermost leaves oblanceolate to elliptic, 5–15 × 2–10 mm. *Inflorescence* of one to two capitula, sometimes with lateral axes; peduncles 60–160 mm long, glabrous. *Capitula* radiate, yellow, rays sometimes flushed red beneath. *Involucre* 8–25 mm diam., involucral bracts 12 or 13, lanceolate to elliptic, 10–13 × 1–3 mm. *Ray florets* 12 or 13, perianth tube 3–5 mm long, limb oblanceolate to oblong, 9–12 × 2–3 mm; ovary oblong to obovoid, appressed-puberulous with twin hairs; style branching shortly above mouth of tube. *Cypselas* oblong to obovoid, 5–7 × 1–2 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 5–10 mm long, dark red. *Disc florets* numerous, perianth tube 1–3 mm long, lobes ovate, 0.5–1.0 mm long; filaments 2–3 mm long; ovary 4–5 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: a poorly collected species endemic to the south coast from Jeffrey's Bay to Port Elizabeth and Grahamstown in Eastern Cape (Fig. 5.16); on sandy coastal flats at altitudes below 100 m. Flowering from April to July.

Diagnosis: *Othonna rufibarbis* is characterised by its strictly cauline, sessile foliage and radiate capitula with 12 or 13 involucral bracts. The pappus is characteristically dark red. It is most easily confused with *O. perfoliata* from further west but that species has straggling stems, and capitula with just 8 or 9 involucral bracts.

Additional specimens examined

South Africa. EASTERN CAPE: **3424 (Humansdorp):** Jeffrey's Bay (–BB), Jul 1927, *Fourcade* 3277 (BOL, NBG, PRE); Irma Booysen Floral Reserve, Cape St Francis near Humansdorp (–BB), 03 Jun 2016, *Logie* FBG 874 (NBG). **3325 (Port Elizabeth):** Addo

(–DA), without date, *Zeyher 3041* (SAM); Walmer near Port Elizabeth (–DC), Apr 1910, *Paterson 1027* (BOL); Port Elizabeth (–DC), Jun 1891, *Bolus 3970* (BOL); Apr 1915, *Paterson 642* (BOL, PRE); New Brighton, near Port Elizabeth (–DC), 19 May 1902, *Galpin s.n.* (PRE); Markman Industries (–DC), 16 May 1973, *Dahlstrand 3038* (PRE).
3326 (Grahamstown): Alexandria (–CB), 05 May 1913, *Galpin s.n.* (BOL).

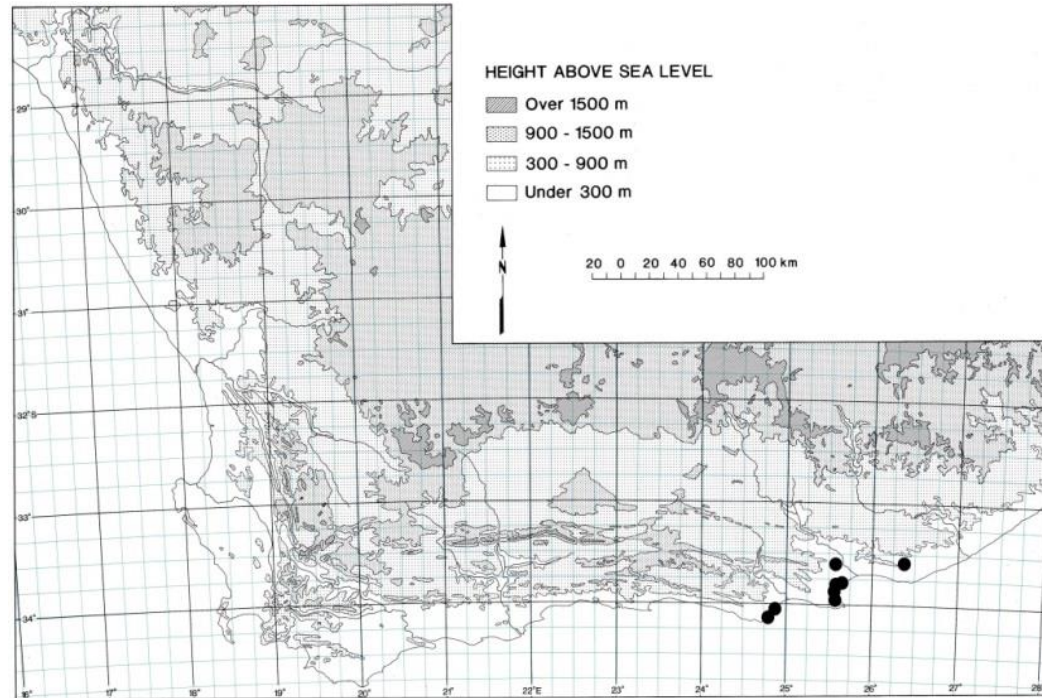


Figure 5.16: Known distribution of *O. rufibarbis*.

17. ***Othonna undulosa*** (DC.) J.C. Manning & Goldblatt in *Bothalia* 40 (1): 39 (2010).
Doria undulosa DC., Prodr. 6: 472 (1838). Type: South Africa, Western Cape, Worcester (3319), 'Hexriviersberg' [Hex River Mountains], (–AD), 03 Jun 1820, *Drège* [289] (G-DC, holo.—microfiche!).

Doria diversifolia DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa 'Carro' [Karoo], without date, *Drège* [427] (G-DC, holo. microfiche!; P—image!, iso.).

Doria chromochaeta DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa, 'Klein Namaqualand', without date, Drège [2875] (G-DC, holo. microfiche!; P—image!, iso.).

Othonna filicaulis sensu Adamson and Salter (1950) and later authors, non Jacq. [= *Othonna perfoliata* (L.f.) Jacq.]

Deciduous geophyte, to 70 cm, with short aboveground stem sparsely branched in upper half, straggling or sprawling among vegetation; rootstock obovoid or turnip-shaped. Leaves cauline, evenly inserted along above ground portion of stem, base of stem leafless, sessile, spreading, clasping, blade lanceolate to ovate, 10–90 × 5–60 mm, entire, sometimes undulate, leathery to sub-succulent, glabrous, upper leaves 15–40 × 5–20 mm, uppermost leaves lanceolate to linear, 5–10 × 2–4 mm; leaves of non-flowering plants cordate and markedly petioled with long, wiry petioles, clasping, blade lanceolate to elliptic. Inflorescence of one to three capitula, sometimes with lateral axes; peduncles 15–120 mm long, glabrous. Capitula disciform, yellow, sometimes white. Involucre 10–30 mm diam., involucral bracts 10 or 12, lanceolate to elliptic, 11–13 × 2–3 mm. Marginal florets filiform, 10 or 12, perianth tube 4–6 mm long; corolla limb reduced, linear, 4–6 mm long; ovary ellipsoid-ovoid, appressed-puberulous with twin hairs; style branching shortly above mouth of tube. Cypselas obovoid, 4–6 × 1–2 mm, thinly appressed puberulous on ribs with non-myxogenic white twin hairs; pappus accrescent, 10–20 mm long, beige or sometimes deep red. Disc florets numerous, perianth tube 1–3 mm long, lobes ovate, 0.5–1.5 mm long; filaments 1–3 mm long; ovary 5–7 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: widespread and common through the coastal and near-inland parts of the Greater Cape Floristic Region, from the mountains of southern Namibia and the Richtersveld in Northern Cape through Namaqualand to the Cape Peninsula in Western Cape, inland to the Klein Roggeveld, and eastwards along the south coast to Uniondale in Eastern Cape but evidently absent from the Little Karoo (Fig. 5.17); on sandy, often coastal flats. Flowering from May to August.

Diagnosis: *Othonna undulosa* is one of three species with a similar erect or scandent habit and sessile, amplexicaul leaves, among which it is immediately distinguished by its disciform capitula and accrescent pappus, elongating up to 20 mm long.

Doria diversifolia DC. (1838) was distinguished by the amplexicaul leaves and 10 involucre bracts. Candolle noted that this might be a variety of *Doria perfoliata* [= *O. perfoliata*] and applied the name to the disciform taxon. *Doria chromocheata* was distinguished by large straw coloured ray floret pappus, amplexicaul leaves and 10 to 12 involucre bracts but is indistinguishable from *O. undulosa*.

The application of the name *O. filicaulis* to the disciform taxon treated here as *O. undulosa* dates to Flora of the Cape Peninsula (Adamson and Salter, 1950). Although there is a conflict in the protologue of *O. filicaulis* between the description and the accompanying illustration, the description and detail of the peripheral floret are clear that the name is applied to a radiate plant. The confused application of the name was clarified by Manning and Goldblatt (2010), who concluded that *O. filicaulis* was conspecific with *O. perfoliata*, and provided the combination *O. undulosa* (DC.) J.C. Manning and Goldblatt for the disciform taxon.

Additional specimens examined

Namibia: **2715 (Bogenfels)**: Klinghardt Mountains (–AC), 6 Aug 2001, *Mannheimer CM1469* (PRE); 27 Jul 1977, *Muller 717* (PRE); Diamond Area No.1 Inselberg of Klinghardt Mountain Range (–AC), 06 Aug 2001, *Germishuizen 10127* (PRE); 13 Aug 2001, *Germishuizen 10315* (PRE). **2716 (Witputz)**: Aurus Mountains (–CB), 13 Jul 1988, *Bruyns 3203* (NBG).

South Africa. NORTHERN CAPE: **2816 (Oranjemund)**: Kodaspiek (–BB), 02 Sep 1977, *Tolken and Venter 465* (PRE); Hottentotsparadysberg, head of Helskloof (–CD), 28 Aug 1977, *Thompson and Le Roux 111* (NBG); Holgat (–DD), 12 Sep 1987, *Jurgens 22732* (PRE); 2 km from Port Nolloth on road to Alexander Bay at Southern boundary of grid (–DD), 07 Sep 1987, *Germishuizen 4810* (PRE). **2817 (Vioolsdrif)**: Paradyskloof, Richtersveld National Park (–AC), Sep 1995, *Williamson 5743* (NBG). **2917 (Springbok)**: Springbok (–DB), 25 Aug 1941, *Barker 1266* (NBG); Hester Malan Wild Flower Reserve (–DB), 01 Jul 1975, *Rosch and Le Roux 1176* (PRE); Namaqua National Park, Kameelboomvlei farm (–CD), without date, *Steyn 1399* (PRE).

3017 (Hondekliipbaai): De Beers Minning Area, N.W of Koingnaas on road to Kleinsee (–AA), 10 Aug 2007, *Steyn 1247* (PRE); Namakwa National Park, Avontuur farm S of Hondekliipbaai road (–AD), 11 Aug 2006, *Koekemoer 3294, 3301* (PRE); Farm 497 N of Spoegrivier (–AD), 30 Jul 2008, *Desmet 3661* (NBG); Kookfontein, NNE of Soebatsfontein, S facing slope of Deelkraalseberg (–BA), 21 Aug 1996, *Desmet 409* (NBG); Grootvlei (–BB), 07 Sep 1945, *Leighton 1233* (PRE); Kamieskroon, Skilpad Wild Flower Reserve (–BB), 13 Jul 1993, *Rooyen 2398* (PRE); Namakwa National Park, along road to Soebatsfontein (–BB), 15 Aug 2005, *Koekemoer 2964* (PRE); ± 1 km N of

Darter's grave between Garies and Kamieskroon (–BD), 23 Sep 2015, *Manning and Magoswana* 3537 (NBG); Koningnaas–Kleinsee road, on Komaggas turn–off, E of Houthoot turn–off (–CC), 11 Aug 2007, *Steyn* 1279 (PRE); Strandveld, Groenrivier (–DC) 10 Sep 1997, *Desmet* 1054 (NBG). **3018 (Kamiesberg)**: Studer's Pass, N of Garies (Helpmekaar) (–AC), 30 Aug 1975, *Oliver* 5952 (NBG). **3119 (Calvinia)**: summit of Van Rhyn's Pass (–AC), 13 May 1831, *Galpin* 12932 (PRE); Niewoudtville Reserve (–AC), 07 Sep 1983, *Snijman* 2300 (NBG); Lokenburg WSW of Calvinia (–CA), 01 Aug 1953, *Acocks* 16850 (PRE); Kliprug (–CB), without date, *Bruyns* 6057 (PRE); Calvinia (–BD), without date, *Schmidt* 585 (PRE).

WESTERN CAPE: **3118 (Vanrhynsdorp)** Bergen (–AB), 21 Jul 1896, *Schlechter* 8263 (PRE); Farm 'Liebendal' 7 miles (11.3 km) N of Vredendal (–CB), 03 Jul 1970, *Hall* 3634 (NBG); Matsikammaberg, SE end between Waterval and Vaalsyfer (–DD), 15 Jul 1974, *Oliver* 4958 (PRE). **3217 (Vredenburg)**: Swartriet farm, Jacobsbaai (–DD), 12 Jul 1993, *Boucher* 5791 (NBG). **3218 (Clanwilliam)**: near Lamberts Bay (–AB), 01 Aug 1947, *Van Breda* 42252 (PRE); 03 Aug 1975, *Van Breda* 4351 (PRE); S of Bullshoek on Clanwilliam–Klawer old road (–BB), 29 Aug 1974, *Goldblatt* 2466 (NBG, PRE); 10 miles (16.1 km) N of Clanwilliam (–BB), 01 Sep 1945, *Compton* 17117 (NBG); Rocherpan Nature Reserve (–CB), 25 Jul 1981, *Le Roux and van Rooyen* 6 (NBG); 21 Aug 1981 (NBG); Citrusdal, Warm baths (–DB), 06 Jul 1935, *Compton* 5400 (NBG); Piekenierskloof above Citrusdal (–DB), 22 Aug 1966, *Rourke* 548 (NBG). **3219 (Wuppertal)**: Ezelbank (–AC), 09 Sep 1996, *Schlechter* 8822 (PRE); Donkergat road, Policemans Kop (–BA), 15 Aug 1966, *Pamphlet* 81 (NBG); Citrusdal. Vuurgat, ± 200 m SE of house (–CA), 25 Jul 1998, *Hanekom* 3048 (NBG); Gideonskop (–CB), 22 Apr

1957, *Stokoe s.n.* (NBG); Kagga Kamma Nature Reserve, near Bobbejaanskop (–DA), 12 Aug 2012, *Koekemoer 4309* (PRE); Swartruggens, Groenfontein, on road to Kagakamma (–DC), 10 Jul 1991, *Van Zyl 4204* (NBG, PRE); Swartruggens, Knolfontein, 60 km NE of Ceres (–DC), 24 Aug 2012, *Jardine and Jardine 313* (NBG).

3220 (Sutherland): road between Laingsburg and Sutherland near Komsberg Pass (–BD), 03 Jul 1983, *Vlok 610* (NBG, PRE). **3318 (Cape Town):** Langebaan, Oosterwal (–AA), without date, *O’Callaghan 27/8/3* (NBG); along R27 North of Yzerfontein on road to Velddrif (–AA), 13 Sep 2000, *Koekemoer and Funk 1927* (PRE); Modderrivier SW of Darling along new National Road (–AD), Jul 1980, *Hugo 2437* (NBG); Darling Flora Reserve (–AD), 28 Jun 1956, *Winkler 96* (NBG); Darling, Tienie Versveld Nature Reserve (–AD), 13 Aug 2010, *Cowell 4312* (NBG); Mamre Road (–BC), 23 Aug 1947, *Compton 19862* (NBG); S of Mamre (–BC), 04 Aug 1974, *Goldblatt 2239* (NBG); 04 Aug 1974, *Goldblatt 2240* (NBG); Dassenberg, Burger’s Post (–BC), 07 Aug 1966, *Rourke 493* (NBG); Malmesbury (–BC), 26 Jun 1948, *Acocks 14510* (PRE); Groot Springfontein (–CB), 02 Aug 1943, *Wasserfall 240* (NBG); Melkbosch turning (–CB), 21 Jul 1946, *Compton 18110* (NBG); 31 Aug 1944, *Compton 15868* (NBG); 29 Aug 1954, *Hall 943* (NBG); Cape Peninsula, Clifton (–CD), 09 Jul 1942, *Barker 1531* (NBG); Camps Bay (–CD), 14 Jun 1925, *Marloth s.n.* (PRE); Sep 1846, *Prior s.n.* (PRE); Sea Point (–CD), 31 Jul 1926, *Smith 2872* (PRE); Cape Peninsula, Hout Bay (–CD), 24 Jul 1942, *Compton 13335* (NBG); 13 Jul 1941, *Compton 10896* (NBG); Wellington (–DB), 06 Aug 1926, *Grant 2314* (PRE); Bellville (–DC), Aug 1912, *Marloth 3298* (PRE); Jul 1912, *Marloth 5198* (NBG); Kuils River, Cape Flats (–DC), Aug 1914, *STEU 836* (NBG); Stikland, Cape Flats (–DC), 30 Aug 1979, *Boucher 4503* (NBG); SW of Kuilsriver (–DC), 16 Aug

1972, *Raïtt s.n.* (NBG); Durbanville, Peaslake (–DC), 20 Jul 1963, *Taylor 4927* (NBG).

3319 (Worcester): rocky foothills of Skurfteberg, Waterryk farm, 44 miles (71 km) N of Ceres on the road to Citrusdal (–AB), 08 Jul 1963, *Taylor 4919* (NBG); Karoo BC), 30 Jun 1940, *Compton 8910* (NBG); 27 Jul 1941, *Compton 11162* (NBG); Karoo Gardens veld (–CB), 25 May 1977, *Perry 165* (NBG); Franschoek (–CC), 21 Jun 1962, *Van der Merwe s.n.* (PRE). **3320 (Montagu):** Klein Roggeveld (–BA), 08 Jul 1938, *Compton 7870* (NBG); N of Montagu (–CC), 11 Jul 1954, *Barker 8272* (NBG). **3323 (Willowmore):** Uniondale, Vette Vlei (–CA), 05 Jul 1935, *Markötter s.n.* (NBG). **3418 (Simonstown):** Red Hill (–AB), 18 Jul 1903, *Phillips 368* (NBG); Blaauwberg strand (–AB), 02 Aug 1943, *Compton 14632* (NBG, PRE); *Compton 20736* (NBG); Cape Peninsula, Clovelly (–AB), 16 Aug 1942, *Compton 13353* (NBG); Kalk Bay (–AB), Aug 1884, *Bolus s.n.* (PRE); Cape Point (–AD), Jul 1903, *Marloth 3245* (PRE); Swartklip [Swartklip] (–BA), 05 Aug 1946, *Compton 18130* (NBG); 17 Aug 1961, *Jordaan J1255* (NBG); Strandfontein (–BA), 17 Jul 1942, *Bond 1515* (NBG); Faure (–BB), 14 Sep 1946, *Nortjè 662* (NBG); Pringle Bay, Buffelsrivier Mouth (–BD), 28 Aug 1971, *German Chemists 16a* (NBG); Betty's Bay (–BD), 28 Jun 1959, *Hall 1737* (NBG). **3419 (Caledon):** Kleinmond, hiking trail from Malherbe S to Palmiet Strand (–AC), 10 Sep 1996, *Mostert 123* (NBG); Kleinmond (–AC), 20 Aug 2001, *Meyer 3851* (PRE). **3420 (Bredasdorp):** De hoop, Potberg Nature Reserve (–AD), 26 Jul 1979, *Burgers 2023* (NBG); 15 Aug 1980, *Burgers 2420* (NBG); 2 km S on road to Bredasdorp (–CA), 20 Jul 2012, *Koekemoer 4265* (PRE); 300 m along the Zoetendals valley turn-off, from the Bredasdorp/L'Agulhas road (–CA), 06 Jul 1995, *Patterson-Jones 433* (NBG); Arniston, Waenhuiskrans (–CA), 24 Aug 1962, *Taylor 3793* (NBG, PRE). **3421 (Riversdale):**

Stillbay (–AD), 17 Aug 1929, *Nel s.n.* (NBG); Botterkloof Farm (–AD), 30 Jul 1981, *Bohnen 7959* (NBG); Stillbay (–AD), 12 Sep 1978, *Bohnen 4151* (NBG); without date, *Muir 8396* (PRE); Albertinia, Ystervarkpunt (Gouriqua) (–BC), 07 Jul 1987, *Willemse 558* (NBG). **3422 (Mossel Bay)**: Goukamma (–BB), 1968, *Heineken 101* (PRE).

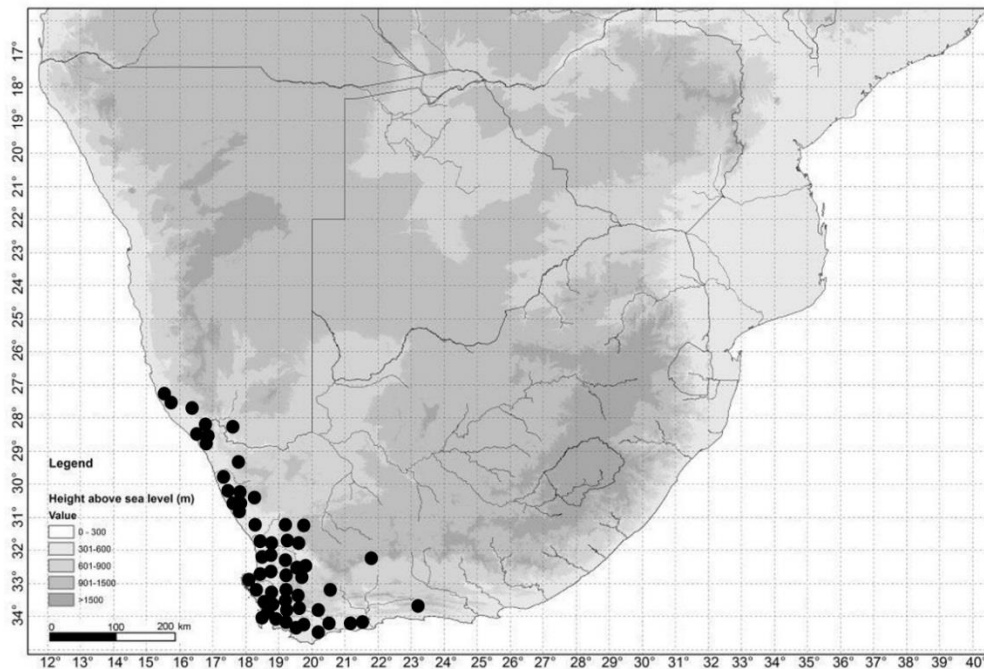


Figure 5.17: Known distribution of *O. undulosa*.

Ser. *Disciformes* Magoswana and J.C. Manning, ser. nov.

Type: *O. gymnodiscus* (DC.) Sch. Bip.

Deciduous geophytes with short underground stem branching shortly above ground level; foliage sessile or conspicuously petiolate, entire or lobed to pinnatifid; capitula disciform, with filiform, female-fertile marginal florets; pappus enlarging to twice the length of the cypselas, pappus bristles 3–15 mm long, beige, sometimes with red bands in one species.

18. ***Othonna gymnodiscus*** (DC.) Sch. Bip., in Flora 27(2): 769 (1844). *Doria gymnodiscus* DC., Prodr. 6: 473 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 327 (1894). Type: South Africa, Eastern Cape, Port Elizabeth (3325), 'in Africae Capensis collibus prope Port Elizabeth distr. Uitenhagen', (–DC), without date, *Ecklon s.n.* (G-DC, holo.—microfiche!, S—image!, iso.).

Doria semicalva DC., Prodr. 6: 473 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 327 (1894). *Othonna semicalva* (DC.) Sch. Bip., in Flora 27(2): 769 (1844). Type: South Africa, Western Cape, Clanwilliam (–3218), 'in Africâ Capensi ad Langevaley et Olifantsrivier' [Rhinosterfontein], (–BC), 15 Jul 1830, *Drège* [2878] (G-DC, holo.—microfiche; P—image!, iso.).

Doria ramosa DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa, Western Cape, 'Hexrivierberg', without date, *Drège* [6065] (G-DC, holo.—microfiche!; P—image!, iso.).

Doria chromochaeta var. *pappodes* DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa, without precise locality or date, *Drège s.n.* (G-DC, holo. microfiche!).

Doria laureola DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa, without precise locality or date, *Drège* [6070] (G-DC, holo. —microfiche!; P—image!, iso.).

Doria tortuosa DC., Prodr. 6: 472 (1838), *syn. nov.* Type: South Africa, without precise locality or date, *Drège* [6062] (G-DC, holo. —microfiche!; P—image!, iso.).

Othonna lingua sensu Goldblatt and Manning (2000), non L.f. [= *O. bulbosa* L.].

Deciduous geophyte, to 40 cm, with short underground stem branching shortly above ground level, branches erect to sprawling; rootstock conical or oblong. *Leaves* crowded basally, sub-erect to spreading, sessile, auriculate or weakly clasping, blade oblanceolate to elliptic, 20–110 × 10–60 mm, entire, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 40–80 × 5–40 mm, uppermost leaves lanceolate to elliptic, 5–15 × 2–10 mm. *Inflorescence* of one to two capitula, sometimes with lateral axes; peduncles 15–150 mm long, glabrous. *Capitula* disciform, yellow. *Involucre* 8–20 mm diam., involucre bracts 12 to 14, elliptic, 9–12 × 2–3 mm. *Marginal florets* filiform, 12 to 14, perianth tube 4–6 mm long; corolla reduced, 2–4 mm long; ovary ellipsoid-ovoid, appressed-puberulous with twin hairs; style branching above mouth of tube. *Cypselas* ellipsoid-ovoid, 4–6 × 1–2 mm, thinly appressed puberulous on ribs with non-myxogenic white twin hairs; pappus 4–15 mm long, beige. *Disc florets* numerous, perianth tube 2–4 mm long, lobes ovate, 0.5–1.0 mm long; filaments 2.0–2.5 mm long; ovary 6–7 mm long; style simple and cone-tipped, rarely with short branches in some individuals but then without lateral stigmatic zones; pappus lacking.

Distribution and ecology: a well collected species best known from the southwestern parts of Western Cape, from Clanwilliam to Paarl in the south but also extending along the south coast and near-interior to Riversdale and Port Elizabeth [only the type] in the east, and north onto the Bokkeveld Escarpment in Northern Cape with isolated collections near Garies in southern Namaqualand (Fig. 5.18); on sandy slopes and flats below 1 000 m. Flowering from May to August.

Diagnosis: *Othonna gymnodiscus* is recognised by the sessile, oblanceolate to elliptic leaves 20–110 × 10–60 mm, and disciform capitula with 12 to 14 involucre bracts, unique among the geophytic species in lacking a pappus on the disc florets. Most other disciform species in the genus have disc florets with a well-developed pappus. *Othonna digitata* has similar shaped but basally narrowed or petiolate leaves, capitula with 8 or 9 involucre bracts and mauve to purple marginal florets, and glabrous cypselas. *Othonna linearifolia*, also with simple leaves and yellow disciform capitula, has slender, erect stems with narrower, linear to linear-lanceolate leaves 4–8 mm wide, capitula with 8 or 9 involucre bracts, and glabrous cypselas.

Othonna gymnodiscus is a vegetatively variable species, with glabrous, oblanceolate to elliptic leaves, with auriculate or weakly clasping leaf base. The disciform capitula have 12 to 14 involucre bracts. As a result of this, Candolle recognised a number of these forms as species separate from *O. gymnodiscus*. *Doria laureola* DC., from an unlocalised collection, was distinguished by lanceolate leaves, 12 involucre bracts and glabrous cypselas; *D. ramosa* DC., based on a collection from the Hexriver Mountains, by its lanceolate leaves, 12 involucre bracts and pubescent cypselas; *D. chromochaeta* var. *pappodes* DC., by its petiolate leaves and pubescent cypselas, and *D. tortuosa* DC., by its linear-lanceolate leaves, 12 involucre bracts and pubescent cypselas. Although the cypselae in *Doria laureola* were described as glabrous, this was largely based on immature fruits, and the hairs are not readily seen at this point. Additional and recent collections of *O. gymnodiscus* (e.g. *Hanekom 1542*, *Olivier 39* and *Midgley and Bosenberg 50*) show immature fruit lacking cypselae hairs. Examination of type material

of all names led to the conclusion that they represent forms of a single species and the variation in leaf shape is taxonomically insignificant.

Additional specimens examined

South Africa. NORTHERN CAPE: **3018 (Kamiesberg)**: Garies (–CA), 24 Jul 1941, *Esterhuysen 5424* (BOL); Stofkraal (–CC), 24 Aug 1991, *Bruyns 4749* (BOL). **3119 (Calvinia)**: Nieuwoudtville (–AC), without date, *Leipoldt s.n.* (BOL).

WESTERN CAPE: **3218 (Clanwilliam)**: Landberg, ridge South of beacon (–BA), 16 Aug 1976, *Linder 650* (BOL); Cederberg, Pakhuis Pass (–BB), 07 Jul 1984, *Taylor 10985* (NBG); Boschkloof (–BB), 09 Sep 1995, *Schlechter 8443* (BOL); Piketberg, Kapteins Kloof (–DA), 25 Sep 1941, *Stokoe 8137* (BOL). **3219 (Wuppertal)**: Sandleege (–BC), 19 Jul 1974, *Linder 357* (BOL); Skoongesig, Koue-Bokkeveld (–CC), 28 Aug 1971, *Hanekom 1542* (NBG, PRE); Knolfontein, Swartuggens, 60 km NE of Ceres (–DC), 07 Aug 2007, *Jardine and Jardine 699* (NBG). **3317 (Saldanha)**: between Saldanha and Vredenburg (–BB), 15 Jul 1946, *Leighton 1751* (BOL). **3318 (Cape Town)**: Burger's Post Farm, Pella (–DA), 04 Jul 1979, *Boucher and Shepherd 4405* (NBG); Heuvelvlak, south-east of Katzenberg (–DA), 25 Jun 1976, *Andray and Boucher 5* (NBG, PRE); flats East of Klipheuvel (–DA), 02 Jul 1934, *Salter 4631* (BOL); Paardeberg, between Wellington and Malmesbury, Vlakfontein ± 2.5 km from Blidjschap Farm buildings (–DB), 23 Aug 2012, *Nicholson and Roets 918* (NBG); 04 Jul 2011, *Nicholson and Roets 144* (NBG); summit of the Paardeberg (–DB), Jul 1931, *Pillans 6673* (BOL); Vrolikheid farm (–DD), without month and date 1971, *Jooste 88* (NBG). **3319 (Worcester)**: rocky foothills of Skurfteberg mountains from the Waterryk farm, 44

miles (70.81 km) N of Ceres on the road to Citrusdal (–AB), 08 Jul 1963, *Taylor 4914* (NBG; PRE); Elandsberg Nature Reserve, middle road (–AC), 10 Aug 2015, *Manning and Magoswana 3513* (NBG); Michell's Pass, below Rooikrans Peak (–AD), 02 Aug 1967, *Rourke 793* (NBG); Ezelsfontein slopes at foot of Milner Peak (–AD), 01 Sep 1952, *Esterhuysen 20352* (BOL); Bain's Kloof, Gevonden Farm (–CA), 28 Aug 1962, *Walters 652* (NBG); Du Toit's Kloof (–CA), 24 Jul 1953, *Compton 24101* (NBG); Karoo Gardens (–CB), 30 Jun 1958, *Willems 47* (NBG); 12 Jul 1948, *Compton 20525* (NBG); 20 Aug 1953, *Compton 24123* (NBG); 18 Aug 1976, *Bayer 184* (NBG); 13 Aug 1986, *Midgley and Bosenberg 50* (NBG); Hex River Valley (–CB), 21 Jun 1953, *Esterhuysen 21588* (BOL); Brandvlei near Worcester (–CB), 26 Aug 1928, *Hutchinson 136* (BOL); Stettynsberg (–CD), without date, *Esterhuysen 15576* (BOL); Robertson (–DD), Jul 1941, *Schmidt 39* (PRE). **3320 (Montagu)**: Doringkloof farm, S-foothills of Voetspadsberg (–AA), 08 Jun 1985, *Van Wyk 2372* (NBG); Whitehill (–AD), 1937, *Archer 882* (NBG); Barrydale (–DC), 15 Sep 1985, *Van Breda 4581* (PRE). **3321 (Ladismith)**: Elandsberg (–AD), 11 Jul 1953, *Warts 1046* (NBG); Gamka Mountain Nature Reserve (–CB), 20 May 1983, *Cattell and Cattell 257* (NBG); Garcias Pass (–CC), without date, *Muir 2950* (PRE). **3418 (Simonstown)**: Theefontein Farm ca. 8 km SW of farmhouse (–AB), 20 Jul 1978, *Boucher 3873* (NBG). **3419 (Caledon)**: between Villersdorp and Caledon (–AB), 18 Aug 2001, *Meyer s.n.* (PRE). **3421 (Riversdale)**: hills near Riversdale (–AB), Aug 1923, *Muir 2753* (PRE).

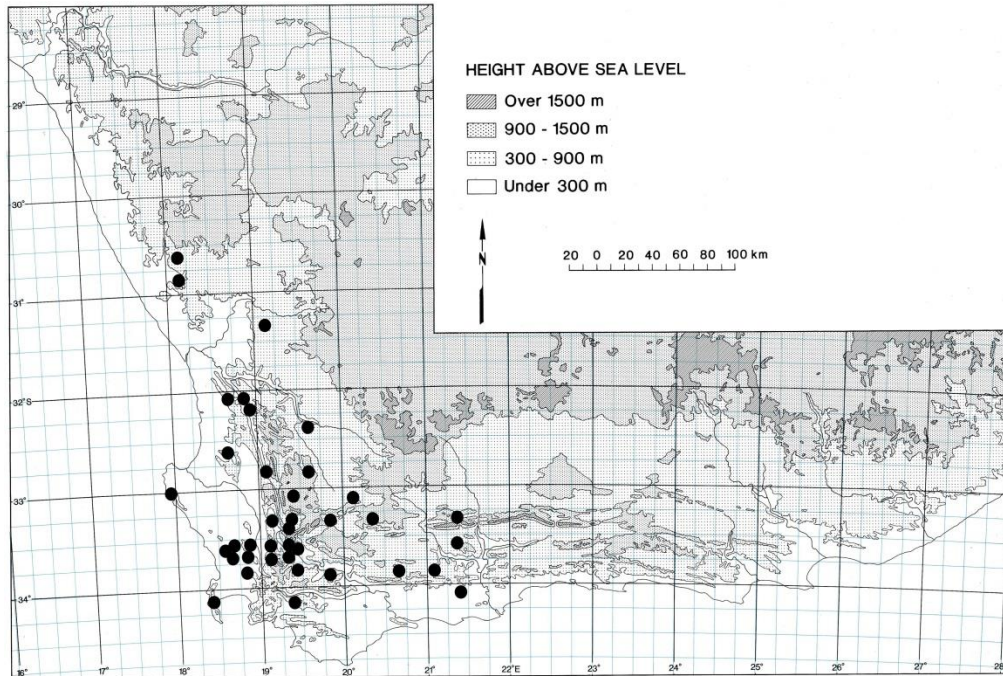


Figure 5.18: Known distribution of *O. gymnodiscus*.

19. ***Othonna digitata*** L.f., Suppl. Pl.: 386 (1782). *Doria digitata* (L.f.) Less. in Linnaea 6: 95 (1831); Syn. Comp. 89 (1832); Harv. in Harv. and Sond., Fl. Cap. 3: 325 (1894).

Type: South Africa [Western Cape], 'Cap Bonae Spei', without date, *Thunberg s.n.*

[UPS-THUNB 20873] (UPS-THUNB, holo. — microfiche!; SBT—image!, iso.)

Doria digitata var. *incisa* DC., Prodr. 6: 471 (1838), *syn. nov.* Type: South Africa, [Western Cape], 'ad Stellenbosch ad flum. Palmiet', without date, *Ecklon s.n.* (G-DC, holo. —microfiche!).

Othonna digitata var. *lanceolata* Harv. in Harv. and Sond., Fl. Cap. 3: 325 (1865), *syn. nov.* Types: South Africa, Western Cape, Clanwilliam (–3218), 'Piquetberg', (–BC), without date, *Zeyher s.n.* (?S, image, *syn.*); South Africa, Western Cape, Cape Town, 'Table Mountain', (–CD), without date, *Ecklon s.n.* (?S, image, *syn.*).

Deciduous geophyte, to 50 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock oblong or turnip-shaped. Leaves crowded basally, erect to spreading, conspicuously petioled, blade oblanceolate to elliptic or cuneate, 60–150 × 20–40 mm, entire or lobed to pinnatifid, leathery to sub-succulent, glabrous, sometimes sparsely hairy, upper leaves sessile and sometimes clasping, 20–90 × 5–20 mm, uppermost leaves lanceolate to elliptic, 5–10 × 2–4 mm. *Inflorescence* of one to two capitula, sometimes with lateral axes; peduncles 50–250 mm long, glabrous. *Capitula* disciform, mauve to purple. *Involucre* 8–20 mm diam., involucral bracts 8 or 9, lanceolate to elliptic, 10–14 × 3–5 mm. *Marginal florets* filiform, 8 or 9, perianth tube 3–5 mm long; corolla reduced, 2–4 mm long; ovary ellipsoid-ovoid, glabrous; style branching above mouth of tube. *Cypselas* oblong to obovoid, 5–8 × 1–3 mm, glabrous; pappus, 7–10 mm long, beige, sometimes with red bands. *Disc florets* numerous, perianth tube 2–3 mm long, lobes ovate, 0.5–1.0 mm long; filaments 1–3 mm long; ovary 2–5 mm long; style simple and conned-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: most commonly collected on the Cape Peninsula inland to Worcester but with scattered records north on the Piketberg and the Olifants River Mts, and eastwards along the southern coast and the Langeberg to Stillbaai (Fig. 5.19); on sandy flats and slopes, usually post-fire. Flowering from June to October.

Diagnosis: *Othonna digitata* is distinctive among the disciform species in its digitate or pinnatifid leaves and its mauve to purple florets. The pappus is accrescent, the bristles reaching 7–10 mm long at maturity. It shares capitula with 8 or 9 involucral bracts and unusual glabrous cypselas with *O. linearifolia*, a slender, erect species with

narrow, linear to linear-lanceolate leaves, 4–8 mm wide, yellow capitula, and cypselas with a short pappus 3–5 mm long. Simple-leaved forms of *O. digitata* can be confused with *O. gymnodiscus* but that species has 12 to 14 involucre bracts and yellow florets with puberulous cypselas.

Othonna digitata is a vegetatively variable species, with digitate or pinnatifid leaves. The mauve to purple disciform capitula have 8 or 9 involucre bracts. This then led Candolle (1838) to recognise one form as a variety separate of *O. digitata*. As such, Candolle (1838), recognised a form as a variety of the species; *Othonna digitata* var. *incisa* DC., based on a collection from Palmiet near Stellenbosch, was distinguished by dentate leaves with obtuse lobes. Harvey (1865) in his treatment of *Doria* further recognised an additional form as a variety of *O. digitata*; *Othonna digitata* var. *lanceolata* Harv., based on collections from Clanwilliam and Table Mountain, was distinguished by entire or dentate leaves. Harvey (1865) also found *Doria campanulata* DC. to be conspecific with *Othonna digitata* var. *lanceolata* and thereby relegated it to synonymy. I have examined the type of *Doria campanulata* in the De Candolle herbarium and find no reason to disagree with Harvey (1865). No differences in bract number were found among these taxa and *O. digitata* and the variation in leaf shape is taxonomically insignificant.

Additional specimens examined

South Africa. WESTERN CAPE: **3218 (Clanwilliam)**: Slopes of Zebra Kop (–DC), 23 May 1948, *Esterhuysen 14488* (BOL, NBG, PRE). **3219 (Wuppertal)**: Sandleege between Levant and Sandleege (–BC), 03 Aug 1974, *Linder 363* (BOL). **3220 (Montagu)**: Farm Seukop near top of Gannaga Pass, Gannakuilsrivier crossing (–AA),

03 Aug 2015, *Manning and Magoswana* 3507 (NBG). **3318 (Cape Town):** northern slopes of Table Mountain (–CD), Aug 1917, *Marloth* 7733 (PRE); Table Mountain (–CD), 23 Aug 1925, *Gonng* 26577 (PRE); Camps Bay (–CD), 06 Jul 1996, *Strey* 912 (PRE); Kenilworth Race Course (–CD), 05 Jul 1903, *Phillips* 198 (NBG); 28 Jul 1968, *Esterhuysen* 31975a (BOL); Kenilworth near Cape Town (–CD), Aug 1892, *Bolus* 3721 (BOL, PRE); Raapenburg, Mowbray (–CD), Jul 1990, *Guthrie* 579 (BOL); Camps Bay Drive (–CD), 05 Jul 1943, *Barker* 2421 (NBG); 29 Jun 1949, *Steyn* 194 (NBG); Table Mountain (–CD), Oct 1906, *Dümmer* 624 (NBG); Heuwelvlak, south-east of Katzenberg (–DA), 25 Jun 1976, *Andray and Boucher* 7, *Andray and Boucher* 8a (NBG, PRE); Paardeberg (–DB), 05 May 2011, *Nicholson* 24 (NBG); Paarl Diamant farm (–DB), 07 Jun 1970, *Acocks* 24272 (PRE); Botlaryberg, on Keepmanskloof farm (–DD), 13 Sep 1988, *Beyers* 61 (NBG); Vissers Hoek (–DD), 28 Jul 1946, *Leighton* 1792 (BOL); Jonkershoek, Stellenbosch (–DD), 28 Jul 1950, *Parker* 4481 (NBG). **3319 (Worcester):** Verkeerdevlei (–BD), 12 Jul 1934, *Barker* 8292 (NBG); Worcester Commonage (–CB), 19 Aug 1990, *Bruyns* 4342 (BOL); hills along road just W of Nekkies on edge of Brandvlei Dam (–CB), 21 Jul 2009, *Le Roux s.n.* (NBG); Franschoek, Zachariashoek catchment (–CC), 03 Sep 1970, *Haynes* H376 (PRE). **3320 (Montagu):** Lemoenshoek (–DD), 21 Oct 1962, *Esterhuysen* 29483 (BOL). **3418 (Simonstown):** Fishoek (–AB), Jun 1920, *Page* 16522 (BOL); Hout Bbay (–AB), 21 Jun 1959, *Hall* 1735 (NBG); Red Hill (–AB), 31 May 1915, *Pillans* 3003 (BOL); 30 Jun 1918, *Pillans* 3118 (BOL); 13 Jul 1960, *Taylor* 2526 (NBG); 05 Aug 1963, *Taylor* 4968a (NBG, PRE); flats NE of Steenberg (–AB), 04 Aug 1998, *Pillans* 3117 (BOL); Constantiaberg (–AB), 19 Aug 1974, *Esterhuysen* 33592 (BOL); Brightwater, Cape Point (–AD), 23 Jun 1944,

Compton 15716 (NBG); Vasco da Gama Peak (–AD), 22 Jun 1943, *Compton 14600* (NBG); Cape Peninsula W of Vasco Da Gama Peak (–AD), 19 Jul 1934, *Salter 4647* (BOL); Rooihoogte (–AD), 29 Sep 1942, *Compton 13776* (NBG); Buffels Bay (–AD), 22 Jun 1943, *Compton 13349* (NBG); Cape Flats (–BA), without date, *Flanagan s.n.* (PRE); Aug 1902, *Marloth 2592a* (PRE); Wynberg sand dunes (–BA), 07 Aug 1846, *Prior s.n.* (PRE); Strand, Harmony Reserve, (–BB), 31 Jul 2000, *Runnalls 1018* (NBG); Somerset West, Helderberg Nature Reserve (–BB), 15 Jul 1994, *Runnalls 690* (NBG). **3419 (Caledon):** Fisherhaven, Hermanus (–AC), 16 Jul 1996, *Palmer 42* (NBG); Hermanus (–AC), 05 Jun 1980, *Bean 363* (BOL); between Stanford and Pearly Beach (–CB), 10 Jun 1950, *Martin 366* (NBG). **3420 (Bredasdorp):** De Hoop, Potberg Nature Reserve (–BC), 02 Aug 1979, *Burgers 2136* (NBG, PRE). **3421 (Riversdale):** Stillbay (–AD), 23 Mar 1979, *Bohnen 5253* (NBG, PRE); 22 May 1979, *Bohnen 5743* (NBG).

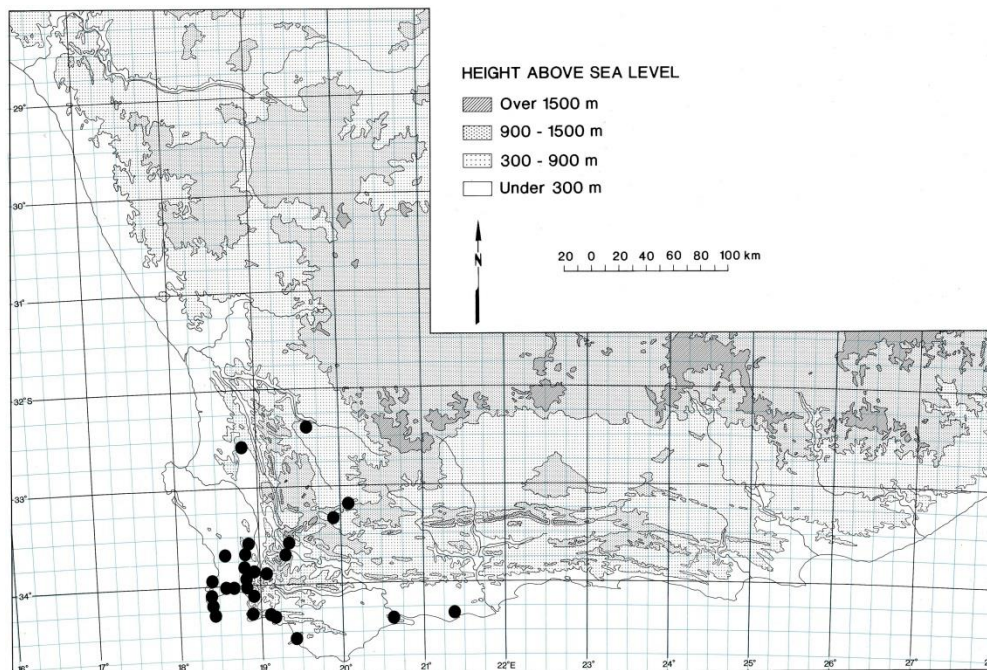


Figure 5.19: Known distribution of *O. digitata*.

20. ***Othonna linearifolia*** (DC.) Sch. Bip., in Flora 27(2): 769 (1844). *Doria linearifolia* DC., Prodr. 6: 471 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 327 (1894). Type: South Africa [Western Cape], 'ad Cap. Bonae-Spei', without date, herb. *L'Héritier* (G-DC, holo.—microfiche).

Deciduous geophyte, to 60 cm, with short underground stem branching in upper half, branches erect; rootstock turnip-shaped. *Leaves* few, erect to sub-erect, sessile, base cuneate to weakly clasping, blade linear or linear-lanceolate, 20–130 × 4–8 mm, entire, leathery to sub-succulent, glabrous, upper leaves sessile, 5–20 × 2–4 mm, uppermost leaves narrowly elliptic to linear, 5–10 × 1–2 mm. *Inflorescence* of one to few capitula on glabrous peduncles 30–90 mm long. *Capitula* disciform, yellow. *Involucre* 5–15 mm diam., involucre bracts 8 or 9, oblanceolate, 7.5–8.5 × 2–3 mm. *Marginal florets* filiform, 8 or 9, perianth tube 2–5 mm long; corolla reduced, 1–2 mm long; ovary ellipsoid-ovoid, glabrous; style branching above mouth of tube. *Cypselas* ellipsoid-ovoid, 1–2 × 0.5–1.0 mm, glabrous; pappus 3–5 mm long, beige. *Disc florets* numerous, perianth tube 1.5–2.5 mm long, lobes ovate, 0.5–1.5 mm long; filaments 2–3 mm long; ovary 2–3 mm long; style simple and conned-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: a rarely collected species known only from the Piketberg and the West Coast near Mamre, mostly below 500 m (Fig. 5.20); on sandy flats among restios. Flowering from April to July.

Diagnosis: a slender species distinguished by its erect stems with narrow, linear to linear-lanceolate leaves 4–8 mm wide, and relatively small, disciform capitula with 8 or 9 involucre bracts and relatively short pappus bristles, 3–5 mm long. *Othonna*

gymnodiscus is mostly a more sprawling plant with broader basal leaves 10–40 mm wide and capitula with 12 to 14 involucre bracts. *Othonna digitata*, another disciform geophytic species with glabrous cypselas, has petiolate basal leaves with a simple to lobed blade, and mauve to purple florets.

Additional specimens examined

South Africa. WESTERN CAPE: **3218 (Clanwilliam)**: Piketberg, De Hoek (–DD), 28 Apr 1947, *Barker 4501* (NBG). **3318 (Cape Town)**: Mamre Commonage (–BC), 31 Jul 2011, *Stummer CR15261* (NBG); 15 Jul 2011, *Stummer FOT1103/CR15174* (NBG); Burger's Post Farm, Pella (–DA), 07 Jun 1979, *Boucher and Shepherd 4365* (NBG); ERF 946, Chatsworth (–DA), 03 Jun 2016, *Koopman 1274* (NBG).

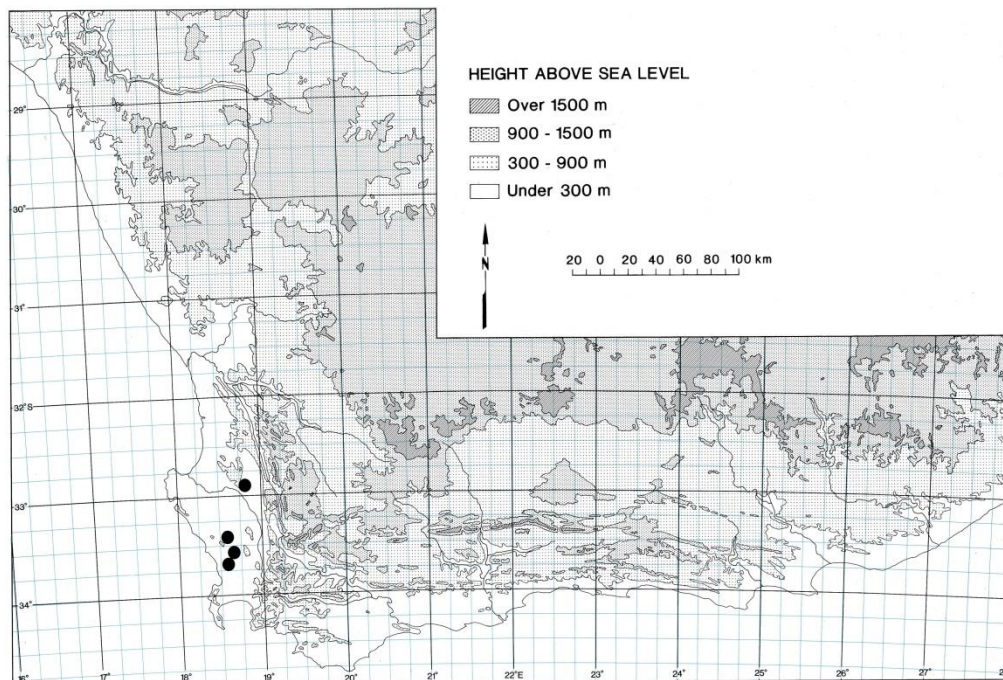


Figure 5.20: Known distribution of *O. linearifolia*.

Ser. *Roseae* Magoswana and J.C. Manning, *ser. nov.*

Type: *O. rosea* Harv.

Deciduous geophytes with short underground stem branching shortly above ground level; capitula radiate with pink to magenta ray florets; pappus bristles 3–10 mm long, beige.

21. ***Othonna rosea*** Harv. in Harv. and Sond., Fl. Cap. 3: 341 (1865). Type: South Africa, [Northern Cape, Springbok], Modderfontein, without date, *Whitehead s.n.* (TCD—image!, holo.; S—image!, iso.).

Othonna cakilefolia var. *latifolia* DC. Prodr. 6: 482 (1838). *Othonna incisa* Harv. in Harv. and Sond., Fl. Cap. 3: 341 (1865). Type: South Africa, [Western Cape, Nuwerus], between Uitkomst and Geelbeksraal, [August 1830], *Drège* (Doc. 95.2) (G—DC, holo.—microfiche!; P—image!, iso.).

Deciduous geophyte, to 50 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock conical or oblong. Leaves crowded basally, sub-erect to spreading, base narrowed and petiole-like, blade oblanceolate to obovate, 40–375 × 25–155 mm, sparsely denticulate to dentate or sharply pinnatifid, lobes obtuse, leathery to sub-succulent, upper leaves sessile, 30–150 × 15–70 mm, uppermost leaves elliptic to linear, 4–40 × 2–20 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 15–180 mm long, glabrous. *Capitula* radiate, rays pink to mauve concolorous disc or rarely yellow discs. *Involucre* 10–25 mm diam., involucral bracts 12 or 13, oblanceolate to elliptic, 9–12 × 2–4 mm.

Ray florets 12 or 13, perianth tube 4–6 mm long, limb elliptic to oblanceolate, 12–15 × 3–6 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 3–5 × 1–3 mm, densely appressed-puberulous on ribs with non-myxogenic white twin hairs; pappus 7–10 mm long, beige. *Disc florets* numerous, perianth tube 1–2 mm long, lobes ovate, 0.5–1.0 mm; filaments 2–3 mm; ovary 6–8 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles, united basally.

Distribution and ecology: endemic to the mountains of Namaqualand in Northern Cape, from the Richtersveld along the western escarpment and the Kamiesberg to Nuwerus (Fig. 5.21); on stony slopes and rock crevices at altitudes below 1 000 m. Flowering from May to August.

Diagnosis: *Othonna rosea* can easily be confused with *O. macrophylla*, with which it shares large leaves, up to 30 cm, with sparsely denticulate to dentate or sharply pinnatifid margins, and capitula with 12 or 13 involucral bracts but is immediately distinguished by the pink to magenta rays, and the longer pappus bristles, 7–10 mm long. It is one of just three species in the genus with pink to magenta rays. The other species are uniformly yellow and rarely white.

Additional specimens examined

South Africa. NORTHERN CAPE: **2817 (Vioolsdrif):** Vioolsdrif (–CB), 24 Sep 1987, *Van Zyl and Jurgens* 22915 (PRE); Perdewater (–CC), 11 Jul 1997, *Bruyns* 7268 (NBG); about 6 miles (10 km) W of Stinkfontein (–CD), 19 Jul 1970, *Wisura* 1647

(NBG). **2917 (Springbok):** Karasberg (–AD), 16 Jul 1995, *Bruyns* 6344 (BOL); Near Klipfontein (–BA), Aug 1929, *Pillans* 6819 (BOL); Steinkopf (–BA), 23 Aug 1983, *Van Wyk* 6198 (PRE); 30 miles (48 km) SW of Springbok (–BA), 23 Jul 1948, *Reynolds* 5444 (PRE); Klipfontein (–BA), 29 Aug 1955, *Compton* 5563 (NBG); Steinkopf, Anenous Pass (–BA), 26 Jun 1967, *Hall* 2435 (NBG); 11 Jun 1954, *Hall* 903 (NBG); 30 May 1954, *Hall* 910 (NBG); 14 Jun 1956, *Hall* s.n. (BOL); Steinkopf (–BC), Aug 1925, *Marloth* 6762 (BOL, NBG); Steinkopf 8 km W of Bulletrap (–BD), 13 Jul 2006, *Bruyns* 10478 (NBG); on N7 to Bulletrap road, W of Bulletrap, on road to Waalheuwel (–BD), 13 May 2005, *Harrower* 1500 (NBG); 19 miles (30 km) S of Port Nolloth near Groot Mist (–CA), 16 Jun 1956, *Hall* 26970 (BOL, PRE); Groot Mist (–CA), 09 Jun 1956, *Hall* 605/52 (BOL); Hills of north of Komaggas (–CD), 05 Jul 1991, *Bruyns* 4614 (BOL); Kourkamma Mountain (–CD), 11 Jul 1989, *Bruyns* 3876 (BOL); 50 km N of Springbok, 10 km west of foot of Spektakel Pass (–DA), 04 Jul 1987, *Bruyns* 2705 (NBG); 10 km south of Nigramoep, Grace's Puts 201 (–DA), 06 Jul 2013, *Helme* 8007 (NBG); Spektakel Pass, W of Springbok (–DB), 15 May 2003, *Manning* 2923 (NBG); Wildepaardehoek, Messelpad Pass (–DC), 13 Aug 2009, *Koekemoer* 3765 (PRE); Messelspad Pass (–DC), 23 Jul 1948, *Compton* 20672 (NBG). **3017 (Hondeklipbaai):** Kamieskroon, Skilpad Wildflower Reserve (–BB), 13 Jul 1993, *Van Rooyen* 2553 (PRE); 7 miles (11 km) S of Kamieskroon (–BB), 01 Jul 1935, *Salter* 5568 (BOL). **3018 (Kamiesberg):** Rusbospoort on the Farm Domsland (–AC), 03 Jun 1980, *Hall* 4932 (NBG); Kamiesberg, N end of Rooiberg (–AC), 10 Jun 1980 *Esterhuysen* 3553 (BOL); Stofkraal (–CC), 24 Aug 1991, *Bruyns* 47550 (BOL); Bruinberg (–CC), 10 Sep 1992, *Bruyns* 5322 (BOL); Stinkfontein, Garies (–CC), Aug 1925, *Marloth* 6720 (PRE).

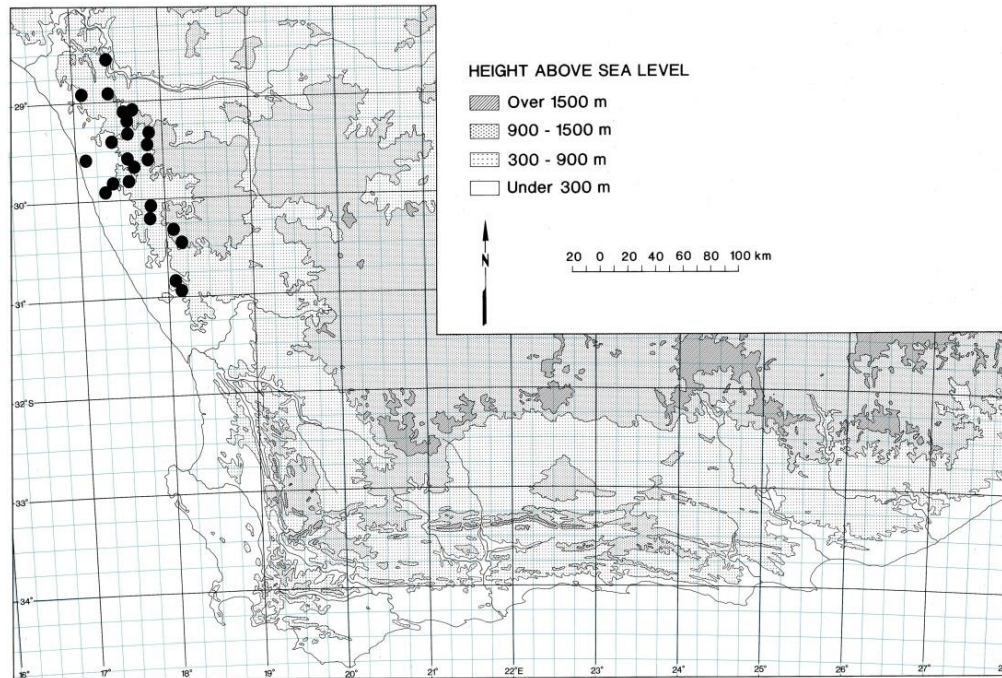


Figure 5.21: Known distribution of *O. rosea*.

22. *Othonna lilacina* Magoswana and J.C. Manning, *sp. nov.* Type: South Africa, Northern Cape, Springbok (2917): 5 miles (8 km) N of Grootmis, (–CA), 20 Aug. 1952, Hall 575 (NBG, holo.).

Deciduous geophyte, to 20 cm, with short underground stem branching shortly above ground, branches erect to sub-erect; rootstock conical or oblong. *Leaves* crowded basally, sub-erect to spreading, base narrowed and petiole-like, clasping, blade cuneate to obovate, 20–70 × 20–50 mm, entire or sparsely denticulate, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 5–30 × 2–20 mm, uppermost oblanceolate to elliptic, 3–10 × 2–8 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 15–100 mm long, glabrous. *Capitula* radiate, lilac or pink. *Involucre* 5–15 mm diam.; involucre bracts 9 or 10, lanceolate to

elliptic, 7–10 × 2–4 mm. *Ray florets* 9 or 10, perianth tube 2–4 mm long, limb elliptic to oblanceolate, 6–10 × 2–4 mm; ovary oblong to obovoid, appressed-puberulous with twin hairs; style branching shortly below mouth of tube. *Cypselas* oblong to obovoid, 4–6 × 1–3 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 3–5 mm long, beige. *Disc florets* numerous, perianth tube 1–1.5 mm long, lobes 0.7–1.0 mm long; filaments 1–2 mm long; ovary 5–7 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally (Fig. 5.22).

Distribution and ecology: known from a few localities near Springbok in Namaqualand (Fig. 5.23), where it appears to occur in patches of quartz-gravel at altitudes below 1 000 m. Flowering from June to August.

Diagnosis: *Othonna lilacina* has been confused with *O. rosea* but can be distinguished from that species by the small entire and sparsely denticulate leaves, fewer involucre bracts and florets (9 or 10), small capitula (5–15 mm diam.) and cypselas with myxogenic twin hairs.

Etymology: This species epithet refers to the lilac or pink capitula.

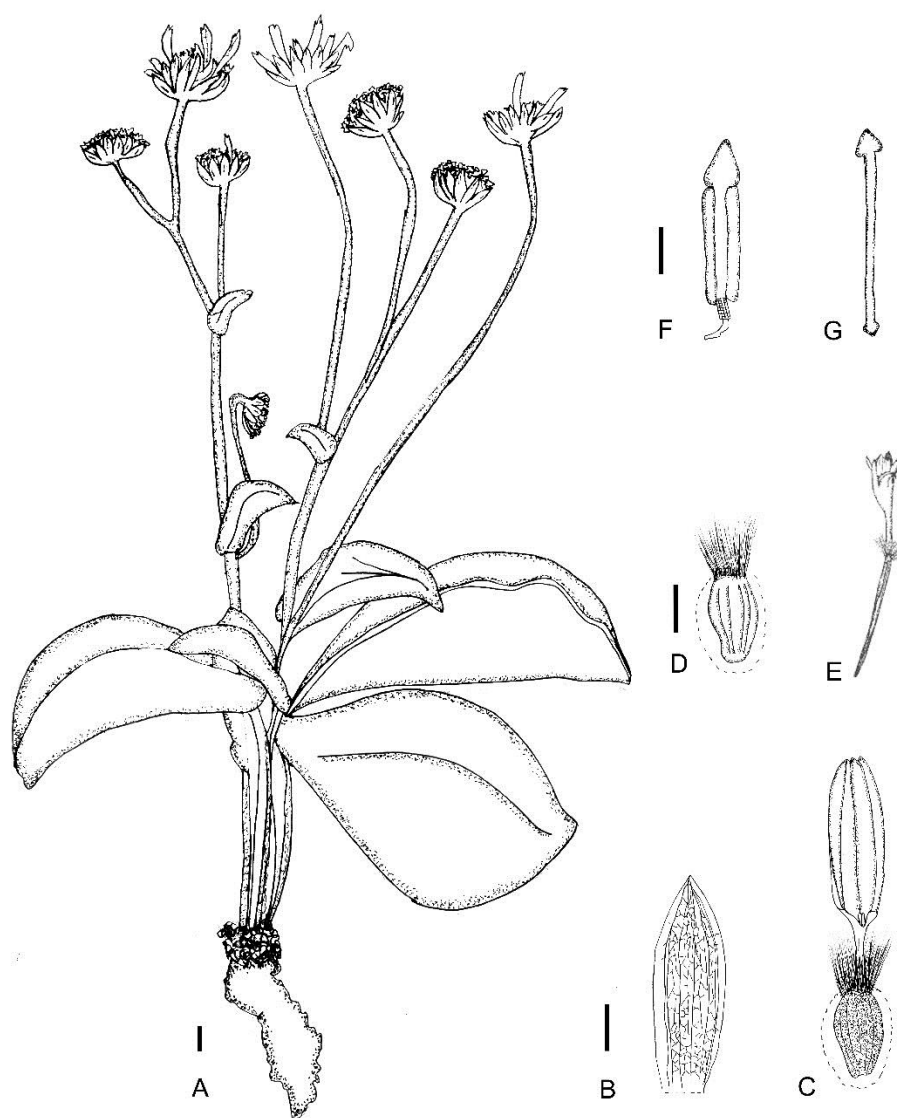


Figure 5.22: *Othonna lilacina*. (A) flowering plant; (B) involucral bract; (C) ray floret (broken line indicates mucilage layer after wetting); (D) cypsela (ray floret); (E) disc floret); (F) anther; (H) style (disc floret). Voucher: *Hall 575*, NBG. Scales: (A) 1 cm; (B–E) 1 mm; (F and G) 500 μm .

Additional specimens examined

South Africa. NORTHERN CAPE: **3017 (Hondeklipbaai)**: Klein Swartkop, ridge SE of beacon (Riethuis) (–AB), 25 Aug 1982, *Oliver 7710* (NBG); Between Soebatsfontein and Wallekraal, S of Farm Kwaggasfontein (–BC), 21 Jul 2005, *Snijman 2008* (NBG).

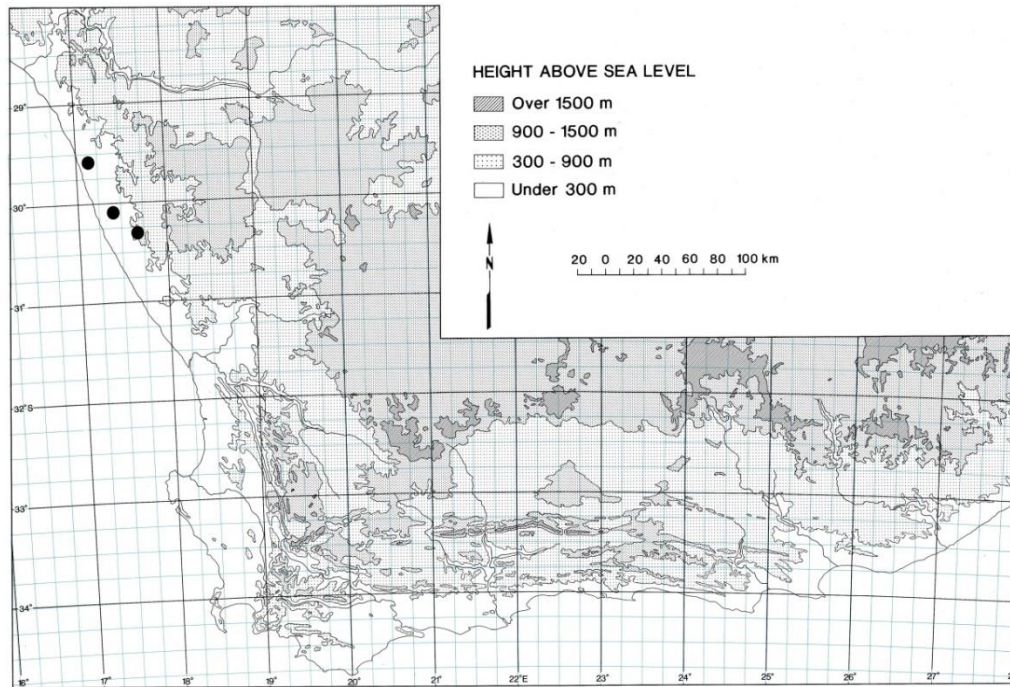


Figure 5.23: Known distribution of *O. lilacina*.

23. ***Othonna cakilefolia*** DC., Prodr. 6: 482 (1838); Harv. in Harv. and Sond., Fl. Cap. 3: 340 (1865). Type: South Africa, Northern Cape, Vanrhynsdorp (3118): 'in Africa Capensi ad Klein Namaqualand' [Bei Holrivier]', (–CB), without date, *Drège* [2872] (G-DC, holo.—image!; K—image!, P—image!, iso.).

Deciduous geophyte, to 50 cm, with short underground stem branching shortly above ground level, branches erect to sub-erect; rootstock conical or oblong. Leaves crowded basally, spreading, base narrowed and petiole-like, blade ovate to elliptic or

rarely linear, 25–120 × 20–110 mm, trifid to pinnatisect, lobes oblanceolate to elliptic, leathery to sub-succulent, glabrous, upper leaves sessile and sometimes clasping, 5–35 × 2–5 mm, uppermost leaves oblanceolate to elliptic, 5–15 × 2–4 mm. *Inflorescence* of one to three capitula, sometimes with lateral axes; peduncles 10–50 mm long, glabrous. *Capitula* radiate, rays and disc magenta. *Involucre* 10–15 mm diam., involucral bracts 10 to 12, oblanceolate to elliptic, 6–8 × 1–2 mm. *Ray florets* 10 or to 12, perianth tube 2–3 mm long, limb oblong, 10–12 × 2–4 mm; ovary oblong to obovoid, appressed-puberulous with twin-hairs; style branching shortly above mouth of tube. *Cypselas* obovoid, 3–5 × 0.5–1.0 mm, densely appressed-puberulous on ribs with myxogenic white twin hairs; pappus 5–6 mm long, beige. *Disc florets* numerous, perianth tube 2–3 mm long, lobes ovate, 1.0–1.5 long; filaments 2–3 × 0.5 mm; ovary 4–6 mm long; style simple and cone-tipped; pappus of ± 10 barbellate bristles united basally.

Distribution and ecology: a poorly collected species known from a few collections between Kamieskroon and Holriver (Fig. 5.24); on sandy flats or quartz outcrops below 500 m. Flowering from June to September.

Diagnosis: *Othonna cakilefolia*, *O. lilacina* and *O. rosea* are the only species in the genus with pink to magenta ray florets. They are distinguished by leaf shape, the leaves of *O. cakilefolia* are trifid to pinnatisect with narrow, obtuse lobes and those of *O. rosea* are oblanceolate to obovate with sparsely denticulate to dentate or sharply pinnatifid margins. Leaves are cuneate to obovate with sparsely denticulate margins in *O. lilacina*.

Additional specimens examined

South Africa. NORTHERN CAPE: **3017 (Hondeklipbaai)**: ± 1 km N of Darter's grave between Garies and Kamieskroon (–BD), 04 Jun 1980, *Hall* 4942 (NBG, PRE). **3018 (Kamiesberg)**: Eenkokerboom (–CC), 03 Sep 1897, *Schlechter* 4297 (PRE).

WESTERN CAPE: **3118 (Vanrhynsdorp)**: NW of Nuwerust (–AA), 27 Jul 1971, *Hall* 4734 (NBG); 15 miles (24 km) W of Nuwerust (–AA), 05 Aug 1956, *Hall* 1029 (NBG); 4 miles (6.4 km) NW Nuwerus, on road to Rietputs, near the farm "Middleputs" (–AB), 09 Aug 1974, *Rourke* 1422 (NBG, PRE); Farm Olifantsrivier (–CB), 13 Jul 2001, *Boucher* 6752a (NBG).

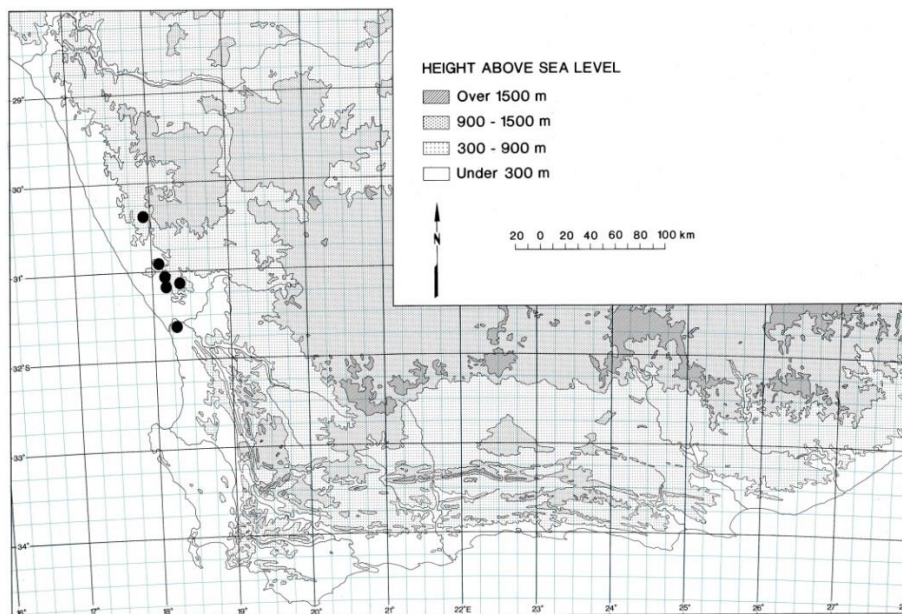


Figure 5.24: Known distribution of *O. cakilefolia*.

CHAPTER 6

GENERAL CONCLUSIONS

The results presented in this study have provided insights into relationships within the Othonninae and among species of *Othonna*. Despite the low resolution and incongruence recovered between gene trees, support for a monophyletic *Othonna* (as currently circumscribed) was largely recovered.

The geophytic species of *Othonna* were divided into two separate morphological groups (the '*O. bulbosa*' group and '*O. auriculifolia*' group), however, these were not recovered as a unit in any of the analyses. Monophyly for the '*O. bulbosa*' group revised in Chapter 5 was largely supported in both the nuclear and combined datasets (ITS, *rps16* and *trnL-trnF*), although the anomalous position of *O. undulosa* in the chloroplast dataset requires further investigation. While species belonging to the '*O. auriculifolia*' group were not recovered with the other geophytic species and also not close to one another. Although the evolution of the geophytic life strategy was not looked at in this study, presented results suggest that the habit may have experienced at least two evolutionary events. This was, however, beyond the scope of this study and requires further exploration.

An expanded phylogenetic sampling within the genus is required to refine, resolve and provide a better understanding of the relationships within the genus. This study has expanded the sampling within *Othonna* but additional gene regions and expanded

sampling of other groups within the genus are required before any conclusions can be drawn.

This study is a first step towards an ultimate revision of the genus, as such, the exact number of species within the '*O. bulbosa*' group was until now not known. The study has uncovered several taxonomic characters that should be explored within the rest of the genus. Leaf morphology characters traditionally used to delimit taxa by previous authors such as Candolle (1838) were found to be inconsistent due to variation within some species or even individuals. In contrast, involucral bract number proved to be a very valuable taxonomic character. The myxogenic fruit found in some of the species suggests that this character may be taxonomically useful in the rest of the genus and should be explored further.

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A taxonomic revision of *Gymnodiscus* (Asteraceae: Senecioneae: Othonninae), a Greater Cape Floristic Region endemic

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ABSTRACT

The South African genus *Gymnodiscus* Less. (Senecioneae: Othonninae) is distinguished from other genera in subtribe Othonninae by its annual habit and lack of pappus in the disc florets. We recognise two species of *Gymnodiscus*, differing in leaf morphology, number of involucre bracts and florets, shape of the ray florets, and cypselar vestiture. A comprehensive taxonomic treatment is presented, including descriptions, complete nomenclature and typification, illustrations and geographical distribution. *Gymnodiscus orbicularifolius* Sch. Bip. is treated as a synonym of *Gymnodiscus capillaris* L.f.

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1. Introduction

The genus *Gymnodiscus* Less. comprises two annual herbs endemic to the Greater Cape Floristic Region of South Africa and favouring sandy flats and gentle slopes (Manning and Goldblatt, 2012). *Gymnodiscus* was established by Lessing (1831) to accommodate the single species *Othonna capillaris* L.f., and was distinguished from *Othonna* L. by the lack of a pappus in the disc florets. The two genera share a uniseriate involucre, and female-sterile disc florets with undivided styles. A second species, *Gymnodiscus linearifolius* DC., was added by Candolle (1838), who recognised the rosulate, annual habit as an additional diagnostic character for the genus. This circumscription of *Gymnodiscus* remains current today (Harvey, 1865; Phillips, 1951; Dyer, 1975; Anderberg et al., 2007). The genus is karyologically derived in having a base number $x = 9$ versus $x = 10$ in *Othonna* (Anderberg et al., 2007).

A secondary character distinguishing *Gymnodiscus* from most species of *Othonna* is the very short pappus in the ray florets, up to 2 mm long. The ray pappus in most species of *Othonna* is much longer, usually 5 to 15 mm long. The dwarf succulent species *Othonnacalioides* L.f. and its allies are anomalous in having ray florets with a very short pappus,

and disc florets with the pappus sometimes reduced to one or two small, caducous bristles. Their relationship to *Gymnodiscus* requires further investigation.

Lessing's (1831) inclusion of *Gymnodiscus* in subtribe Othonninae has been confirmed by the molecular phylogenetic analysis of Pelter et al. (2007), which retrieved it as sister to the genus *Crassothonna* B. Nord., recently segregated from *Othonna* by Nordenstam (2012) and characterised by its consistently shrubby habit, highly succulent, subglobose to fusiform leaves, small, radiate capitula, and relatively short, pure white pappus. *Othonna* itself is rather more diverse, including geophytes, subshrubs and succulents with more or less plane leaves, radiate or disciform capitula, and a creamy-buff pappus that is accrescent or not in the ray florets.

Gymnodiscus was last treated taxonomically by Harvey (1865), who accepted *Gymnodiscus capillaris* L.f. and *G. linearifolius* DC. as good species and included a third, *Gymnodiscus orbicularifolius* Sch. Bip. (1844), as a doubtful species. The taxonomic status of this latter name has remained unresolved until now, with Phillips (1951) crediting the genus with three species but Dyer (1975) and later accounts (Manning and Goldblatt, 2012) recognising just two.

We provide a comprehensive taxonomic treatment of the genus, including complete nomenclature and typifications, detailed descriptions and illustrations, and the known geographical distribution for both species. This paper is the first in a larger systematic study of *Othonna* and allied genera.

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2. Material and methods

All relevant types as well as all collections from BOL, NBG, PRE and SAM were studied (acronyms following Holmgren et al., 1990; Thiers, 2015). Species localities are cited following the Quarter Degree Reference System (Edwards and Leistner, 1971; Leistner and Morris, 1976). All species were also studied in the field. Drawings were made with the aid of an Olympus SZ61 stereomicroscope and Zeiss compound microscope.

3. Taxonomy

Gymnodiscus Less. in Linnaea 6: 95 (1831); Syn. Comp. 89 (1832); Benth. & Hook.f. in Gen. Pl. 2: 452 (1883); Harv. in Harv. & Sond., Fl. Cap. 3: 345 (1865); Anderberg et al. in Kubitzki., Fam. & Gen. Vasc. Pl. 8: 237 (2007). Type: *G. capillaris* (L.f.) DC.

Annual, rosetteform herbs to 40 cm, branching from base, crown and sometimes leaf axils cobwebbed; with slender taproot. Leaves rosulate, prostrate or spreading to suberect-recurved, either fusiform and succulent, or obovate–spathulate to oblanceolate or lyrate–pinnatifid and coriaceous, often purple on reverse or mottled purple, mucronulate. Inflorescence subscapose, peduncles one to several from crown, branched above, sometimes with lateral peduncles from the axils of leaf-like cauline bracts, upper inflorescence bracts small, linear to cordate. Capitula heterogamous, radiate, in small corymbose or sub-umbellate clusters, aggregated into compounded panicle synflorescences. Involucre campanulate to sub-globose, ebracteate [ecalyculate], bracts uniseriate, 5 or 8(9), free, lanceolate to elliptic, glabrous, margins scarious, green with darker apices. Receptacle conical, punctate, glabrous, epaleate. Ray florets female-fertile, 5 to 9, yellow, limb elliptic-ovate; ovary ellipsoid to ob-ovoid, glabrous or appressed-puberulous with twin-hairs; style terete, with slightly thickened base, branches with discrete lateral stigmatic areas, apices narrowly obovate and shortly papillate. Cypselas ellipsoid-

ovoid, 0.8–1.5 mm long, 5-ribbed, dark brown, glabrous or densely appressed-puberulous with white twin hairs; pappus of short, basally united, barbellate bristles one quarter as long as cypselas, persistent, white. Disc florets functionally male, few to many, yellow, perianth tube funnel-shaped, 5-lobed, lobes spreading; anthers obtuse at base with ovate apical appendage, filament collar balusteriform; ovary narrowly ellipsoid, glabrous; style simple, cone-tipped; pappus lacking.

Diagnosis: rosetteform annual herbs with scapose peduncles bearing small, ecalyculate capitula in small corymbs or subumbellate clusters; involucre bracts 5 or 8(9); ray florets female-fertile, pappus of short barbellate bristles; disc florets male-fertile with undivided, cone-tipped style, pappus lacking.

Distribution and ecology: 2 spp., endemic to the Greater Cape Floristic Region of South Africa, usually on sandy flats or gentle slopes in sandy soils.

Key to species of *Gymnodiscus*

1a. Leaves obovate–spatulate to oblanceolate or lyrate–pinnatifid, leathery, often purple on underside; ray florets with perianth tube short (0.3–0.5 mm long) and style well exerted from tube and branching above it; ray ovaries and cypselas puberulous. *G. capillaris*.

1b. Leaves terete-fusiform, succulent, glaucous; ray florets with perianth tube longer (1.0–1.5 mm long) and style included and branching just below mouth of tube; ray ovaries and cypselas glabrous. *G. linearifolius*.

1. *Gymnodiscus capillaris* (L.f.) DC., Prodr. 6: 469 (1838); Snijman, Plants of the Greater Cape Floristic Region. 2: The Extra Cape Flora: 296 (2013); Manning & Goldblatt, Plants of the Greater Cape Floristic Region: 381 (2012); Harv. in Harv. & Sond., Fl. Cap. 3: 345 (1865). *Othonna capillaris* L.f., Suppl. Pl.: 388 (1782). Type: South Africa [Western Cape], Cap Bonae Spei [crescit in campis sabulosus inter Cap et Drakensteen (Thunberg, 1823)] [without date], Thunberg s.n. (LINN [HL1038-20]-image!, lecto., designated here; SBT-image!, UPS-THUNB!, LD-image!., possible isolecto.). [Note: We select as lectotype

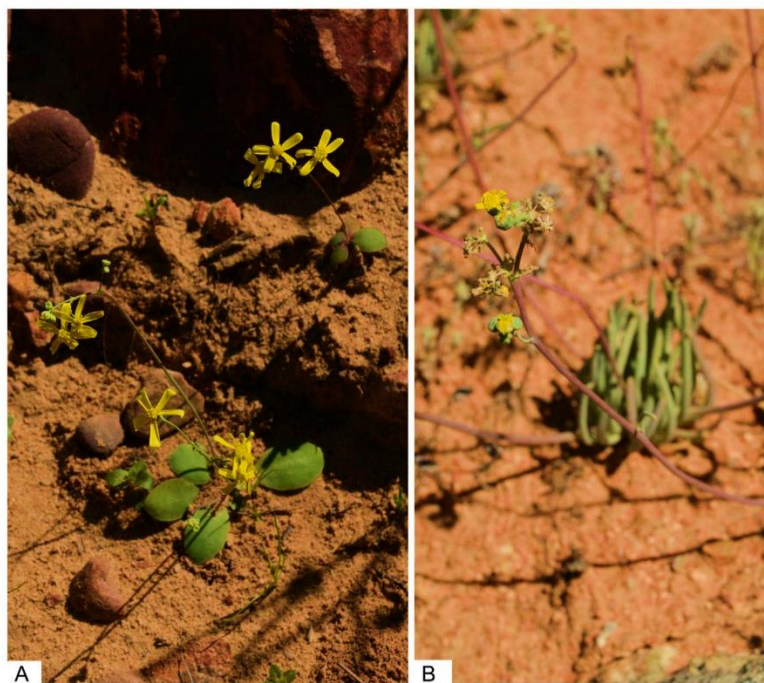


Fig. 1. General morphology of *Gymnodiscus*. A. Habit of *G. capillaris* showing obovate–spatulate to oblanceolate basal leaves and capitula with 5 ray florets; B. habit of *G. linearifolius* showing the fusiform leaves and capitula with 8 or 9 ray florets.

the collection at LINN as most likely representing the original material seen by Linnaeus f., whose herbarium is partly at LINN (Stafleu & Cowan, 1981)]

G. orbicularifolius Sch. Bip. in Flora 27(2): 768 (1844), syn. nov. Type: South Africa, 'in arenosis pl. capensis', 1836, Zeyher s.n. (P[0001623], holo.-image!).

G. capillaris var. *latifolius* Sond. [as *latifolia*] [in Harv.] in Harv. & Sond., Fl. Cap. 3: 345 (1865), syn. nov. Type: South Africa [Western Cape], Saldanha Bay [without date], Ecklon & Zeyher s.n. (S, holo.-image!).

Annual, rosetteform herb to 20 cm, cobwebbed at crown and thinly cobwebbed in peduncle axils. Leaves prostrate or spreading, obovate-spatulate to oblanceolate or lyrate-pinnatifid with 5 to 9 lobes, margins entire or dentate-mucronulate, 10–60 × 5–40 mm, apex mucronulate or obtuse, base cuneate, narrowed below and petiole-like, coriaceous to sub-succulent, often purple on reverse or mottled purple. Peduncles 2–3 mm diam., leaf-like cauline bracts lanceolate to broadly elliptic, entire or coarsely dentate, 4–55 × 3–15 mm, sessile and sometimes clasping, upper inflorescence bracts smaller, cordate, 5–35 × 2–6(–10) mm. Capitula in small cymose or sub-umbellate clusters aggregated into paniculate synflorescences; pedicels 4–30 mm long. Involucre campanulate, 3–5 mm diam.; involucre bracts 5, lanceolate to elliptic, 2.0–3.5 × 1.0–1.5 mm. Ray florets 5, perianth tube very short, 0.3–0.5 mm long, limbs elliptic-ovate, 1.0–2.0 × 0.2–0.5 mm; ovary obovoid, appressed-puberulous with twin-hairs; style exserted from

tube and branching above the mouth. Disc florets 12 or 13, perianth 0.8–1.0 mm long, lobes ovate, 0.2–0.4 × 0.3 mm; anthers 0.8–1.0 mm long; ovary narrowly ellipsoid, glabrous. Cypselas oblong-ovoid, 0.8–1.0 × 0.4–0.6 mm, densely appressed-puberulous with white twin hairs. Pappus bristles 0.5–1.0 mm long. (Figs. 1A and 2).

Distribution and ecology: Widespread through the western half of the Greater Cape Floristic Region, occurring in north-central Namaqualand between Steinkopf and Garies, and from the Bokkeveld Mtns southwards to the Cape Peninsula thence eastwards through the upper Breede River Valley and the Hex River Valley to Tweedside and along the coast to Mossel Bay (Fig. 3); on sandy flats and lower slopes, mainly in fynbos. The species is absent from the Little Karoo. Flowering is from July to October.

Diagnosis: Distinguished from *G. linearifolius* by the leathery, obovate-spatulate to oblanceolate or lyrate-pinnatifid leaves (Fig. 2B1–B3) and smaller capitula, 3–5 mm diam., with 5 involucre bracts and the same number of ray florets, and 12 or 13 disc florets. The ray florets have a very short perianth tube, 0.3–0.5 mm long, with the style well exserted from the tube and branching above it (Fig. 2D and F). The ray ovaries and cypselas are densely appressed-puberulous (Fig. 2D and F).

The species is variable in the degree of incision of the leaves. The northern populations from Steinkopf to Citrusdal have consistently obovate-spatulate leaves, either entire or denticulate (Fig. 2B1), but

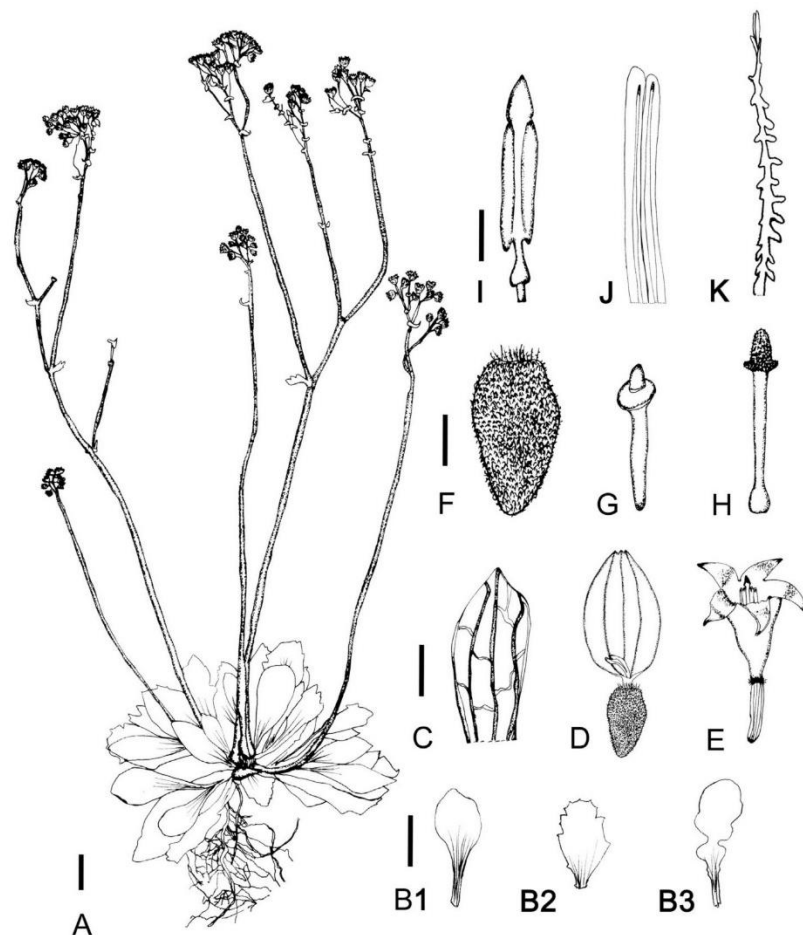


Fig. 2. *Gymnodiscus capillaris*. (A) flowering plant; (B1–B3) leaves; (C) involucre bract; (D) ray floret; (E) disc floret; (F) cypsel (ray floret); (G) ovary (disc floret); (H) style (disc floret); (I) anther; (J) detail of ovary hair showing twin cells; (K) pappus bristle. Voucher: Maguire 195, NBG. Scales: (A & B1–B3) 1 cm; (C–E) 1 mm; (F–K) 500 μ m. Artist: S.L. Magoswana.

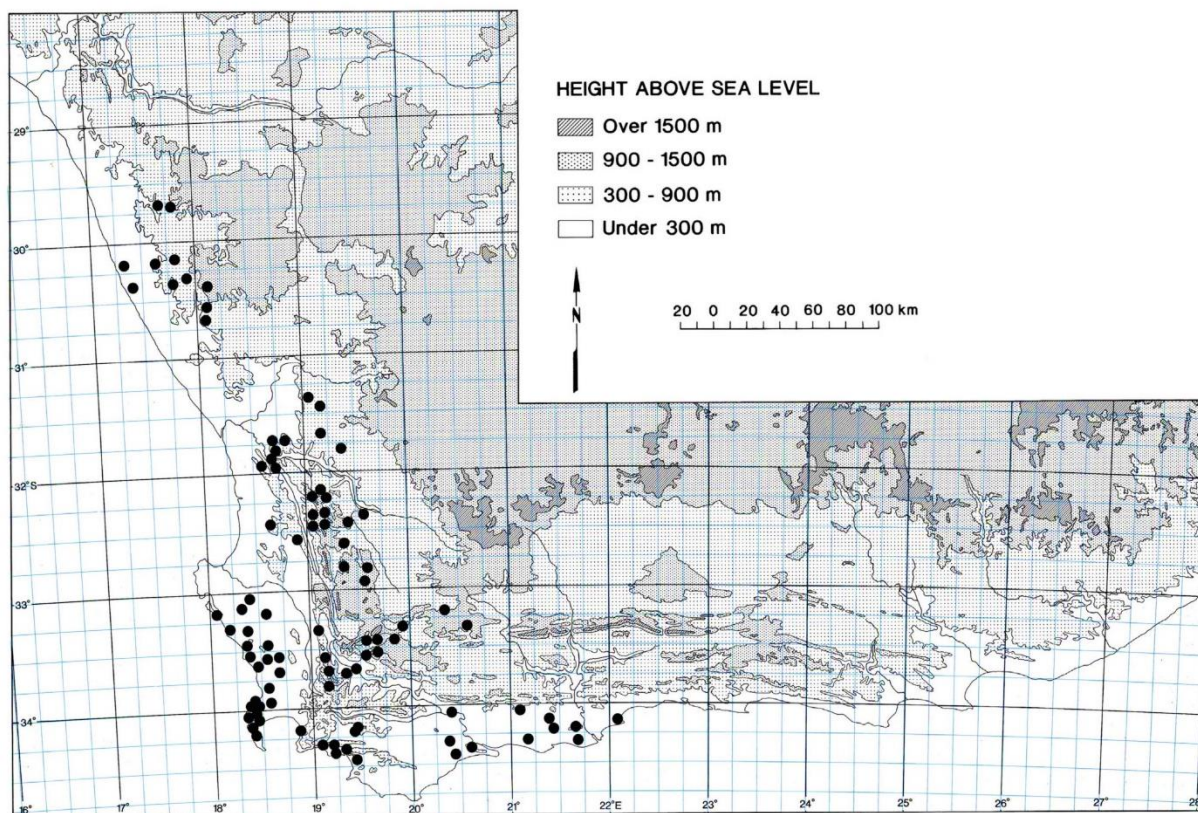


Fig. 3. Distribution of *G. capillaris*.

the populations from Citrusdal to Mossel Bay have the leaves variously entire to toothed or lobed (Fig. 2B2). Populations with lyrate-pinnatifid leaves (Fig. 2B3) are common on the Cape Peninsula but individuals with this leaf form also occur to the east and as far north as Piketberg. The Namaqualand plants comprise a morphologically distinct group of populations characterised by their relatively large, obovate to suborbicular leaves with entire or denticulate margins, and often more stiffly erect peduncles, usually simple and scapose and only rarely with lateral branches in the lower half, with sub-umbellate clusters of capitula. The distinction between this form and populations from the Core Cape Floristic Region is not, however, consistent, and we have encountered various intermediates between the two forms that make it impossible for us to segregate them taxonomically. Several collections (e.g. Maguire 93 (NBG)) comprise individuals showing all the known leaf variations within the species, from obovate-spathulate to oblanceolate or lyrate-pinnatifid.

The large variation in leaf morphology in the species has resulted in the recognition of two additional taxa in the past. The species is typified by a collection from the Boland area near Stellenbosch with lyrate-pinnatisect leaves. An unlocalised collection of C.L.P. Zeyher with sub-rotund, entire leaves was distinguished as *G. orbicularifolius* by Schultz (1844), who also considered it to have slightly larger, paler yellow capitula. The type collection was clearly identified bearing Schultz's manuscript name and as having been annotated by Zeyher as *Othonna bulbosa*. A specimen correct in all these details and housed in the Muséum national d'Histoire naturelle Paris herbarium (P) is thus evidently the holotype. This specimen was not seen by Harvey (1865), who treated *G. orbicularifolius* as a doubtful species. His opinion has been generally followed but the name has not been formally reduced until now.

Plants matching the type of *G. orbicularifolius* are concentrated in Namaqualand but occur sporadically throughout the range of the species, and we are unable to maintain the species. We also find no differences in flower colour or size of capitula between these plants and others in the species.

A collection from Saldanha Bay with very broad leaf-like peduncular bracts was recognised as var. *latifolia* Sond. (Harvey, 1865) but it represents merely well-grown plants with lateral branches. Specimens matching it occur throughout the range of the species among more typical individuals.

Additional specimens seen

South Africa. Northern Cape: **2917 (Springbok)**: Spektakelberg (–DA), 02 Oct. 1933, Herre 19002, 12741 (NBG); near Springbok (–DB), Sep. 1939, Gill 54335 (SAM). **3017 (Hondeklipbaai)**: Namakwa National Park, Farm Roodelaagte, W of Jantjieskop (–AB), 11 Aug. 2006, Koekemoer 3803 (PRE); Langklip, N of Spoegrivier (–AD), 31 Jul. 2008, Desmet 3682 (NBG); Grootvlei, Farm Kotze, Soebaatsfontein (–BA), 30 Sep. 1980, Evrard 8922 (PRE); Skilpad Wildflower Reserve (–BB), 06 Aug. 1996, Cruz 158 (NBG); road to Modderfontein Farm (–BB), 27 Sep. 1911, Sladen 6993 (BOL); Spoegrivier road (–BD), 09 Aug. 2007, Steyn 1224 (PRE); Darter's grave, 22 km W of Garies (–BD), 15 Aug. 1979, van Jaarsveld 4288 (NBG); 22 Sep. 2015, Manning & Magoswana 3538 (NBG). **3018 (Kamiesberg)**: Studer's Pass, E of Garies (–AC), 06 Sep. 1976, Goldblatt 4044 (PRE); Garies (–CA), 29 Jul. 1937, Verdoorn 1890 (PRE); 19 miles [31 km] N of Garies (–CA), 14 Sep. 1963, Merxmüller & Gies 3848 (PRE); between Garies and Kamieskroon, Klip Vlei (–CA), Nov. 1931, Thorne 49952 (SAM). **3119 (Calvinia)**: Nieuwoudtville, Meulsteenvlei (–AC), 08 Aug. 1983, van Wyk 1326 (NBG); Oorlogskloof Nature Reserve (–AC), 04 Sep. 1996, Pretorius 345

(NBG); Lokenberg (–CA), 17 Sep. 1955, *Acocks* 18469, 18 Sep. 1955, *Leistner* 329, 10 Oct. 1953, *Story* 4378 (PRE); top of Botterkloof Pass (–CD), 24 Aug. 1950, *Maguire* 195 (NBG).

Western Cape: **3118 (Van Rhynsdorp)**: Banks of Olifants River between Clanwilliam and Vanrhynsdorp (–CA), Oct. 1931, *Thorne* 49948 (SAM); Matsikammaberg, SE end between Waterval and Vaalsyfer (–DA), 15 Jul. 1974, *Thompson* 2098 (NBG, PRE); Wiedouw, near Gifberg (–DB), 21 Sep. 1985, *Zietsman and Zietsman* 1088 (PRE); Gifberg, slopes SE of Windhoekberg above Klawer (–DC), 13 Jul. 1974, *Oliver* 4931 (NBG); Gifberg (–DC), Sep. 1911, *Phillips* 7422 (BOL, NBG, SAM); Nardouw Kloof (–DC), Sep. 1947, *Stokoe s.n.* (SAM); Grootvlei (–DC), 03 Sep. 1951, *Maguire* 971 (NBG). **3218 (Clanwilliam)**: along road N7, about 15 km S of Clanwilliam (–BB), 13 Jun. 2004, *Forest & Manning* 510 (NBG); Schuinskraal Farm near Redelinghuys (–BC), 12 Aug. 2004, *Boucher* 7148 (NBG); 21 miles [34 km] N of Piketberg on Redelingshuys road (–BC), 28 Jul. 1950, *Lewis* 64013 (NBG), *Lewis* 64015 (SAM); 3 miles (5 km) S of Grey's Pass (–DB), 21 Aug. 1950, *Maguire* 93 (NBG), *Lewis* 64013 (PRE, SAM); Grey's Pass (–DB), 06 Sep. 1949, *Steyn* 365 (NBG). **3219 (Wuppertal)**: 1.5 km from Pakhuis gate towards Heuningvlei (–AA), 15 Oct. 1985, *Taylor* 11393 (NBG); Heuningvlei, Groot Koupoort (–AA), 11 Oct. 1975, *Kruger* 1698, 14 Sep. 1976, *Welman* 131 (PRE); Citadel Kop (–AA), 08 Sep. 1953, *Compton* 24272 (NBG); E of Uitkyk Pass (–AC), 28 Sep. 1949, *Jordaan s.n.* (NBG); Cederberg Forest Reserve,

Middelberg-Suid (–AC), 20 Aug. 1982, *Viviers* 520 (NBG); Nieuwoud Pass (–AC), Sep. 1930, *Barnes s.n.* (BOL); Matjiesrivier Nature Reserve, Leeuvlak (–AD), 06 Sep. 2003, *Low* 8611 (NBG); Sep. 1931, *Compton* 3447 (BOL); Cederberg State Forest, Groot Koupoort Vlake (–AD), 28 Aug. 1979, *Forsyth* 32 (NBG, PRE); Kromme River (–BC), Dec. [without year], *Shaw s.n.* (BOL); Gonnafontein Valley (–CB), 02 Sep. 2000, *Pond* 142 (NBG); jeep track to Bloukop on Luiperdskloof 4x4 route (–CD), 17 Oct. 1989, *Koekemoer* 2423 (PRE); Reitvlei Farm at base of Katbakkies Pass, W of Rietrivier (–DC), 23 Sep. 1991, *Reid* 1450 (NBG); Swartruggens, Knolfontein (–DC), 22 Aug. 2005, *Jardine and Jardine* 66 (NBG). **3318 (Cape Town)**: Langebaan, Postberg (–AA), without date, *Craven* 71 (NBG); Hopefield, Waterboerskraal (–AB), 15 Jun. 1975, *Hugo* 230 (NBG); Hopefield (–AB), Sep. 1996, *Nel s.n.* (NBG); Yzerfontein (–AC), 21 Aug. 1938, *Compton* 7933 (NBG); Darling Flora Reserve (–AD), 25 Jun. 1956, *Winkler* 105 (NBG); Modderivier SW of Darling along new national road (–AD), July 1980, *Hugo* 2428 (NBG); Moorreesburg (–BA), 15 Jun. 1946, *Jordaan* 603 (NBG); Malmesbury (–BC), 01 Sep. 1963, *Bayliss* B5/1659 (PRE); S of Mamre (–CB), 26 Oct. 1977, *Esterhuysen* 34744 (BOL); 7th gate to Bokpoint (–CB), 15 Sep. 1940, *Kies s.n.* (NBG); Salt River dunes (–CD), 14 Aug. 1898, *Froembling* 866 (NBG); Rondebosch Golf Course (–CD), 06 Jul. 1903, *Phillips* 202 (NBG); Camp's Bay (–CD), Sep. 1897, *Thode* 8859 (NBG); Sep. 1886, *MacOwan* 521, 2742 (BOL); Cape Town (–CD), without date, *Bolus* 3254 (BOL); sandy flats E

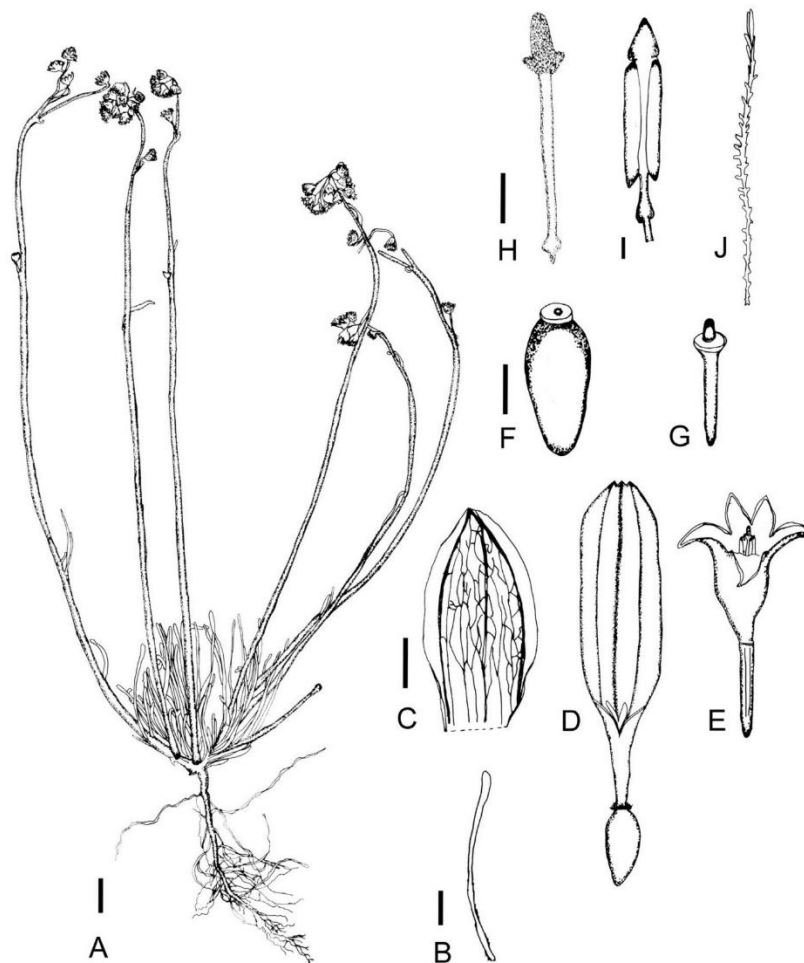


Fig. 4. *Gymnodiscus linearifolius*. (A) flowering plant; (B) leaf; (C) involucral bract; (D) ray floret; (E) disc floret; (F) cypsela (ray floret); (G) ovary (disc floret); (H) style (disc floret); (I) anther; (J) pappus bristle. Voucher: *Snijman* 2168, NBG. Scales: (A&B) 1 cm; (C–E) 1 mm; (F–J) 500 μ m. Artist: S.L. Magoswana.

of Mowbray (–CD), 12 Oct. 1913, *Pillans 2137* (BOL); Paardeberg, Vlakfontein Farm, ± 1 km E of R302 (–DA), 18 Jul. 2011, *Nicolson & Roets 180* (NBG); Heuwelvlak, SE of Katzenberg (–DA), 31 Jul. 1976, *Andrag & Boucher 8b, 12* (NBG); near Pella, Burger's Post Farm, Fynbos Biome research site (–DA), 31 Aug. 1979, *Boucher & Shepherd 4519* (NBG); Cape Town to Malmesbury, roadside (–DC), 06 Sep. 1973, *Montgomery 454* (NBG); 3 miles (5 km) from Durbanville on the Langeberg road to Kraaifontein (–DC), 20 Jul. 1963, *Taylor 4925* (NBG). **3319 (Worcester)**: Tulbagh Kloof (–AC), Sep. 1880, *Tyson 2307* (SAM); next to main road passing De Doorns (–BC), 16 Sep. 1974, *Mauve and Oliver 130* (NBG); Karooport (–BC), Aug. 1919, *Marloth s.n.* (NBG); Matroosberg (–BD), 29 Aug. 1930, *Gillett 3882* (NBG); near Verkeerde vlei (–BD), Sep. 1933, *Levyns 4617* (BOL). Du Toit's Kloof (–CA), 19 Jul. 1962, *Walter 9* (NBG); Bainskloof (–CA), 19 Oct. 1928, *Gillett 1733* (NBG); east bank of Brandvlei, near Worcester (–CB), 16 Jul. 1986, *Snijman 1049* (NBG); slopes N of Dewetsberg (–CB), 08 Sep. 1972, *Bremer 144* (NBG); Wemmershoek (–CC), 27 Aug. 1939, *Thorns s.n.* (NBG); Over-Hex (–DA), 04 Aug. 1949, *Morris 143* (NBG); Hex River Valley (–DA), Oct. 1880, *Taylor 702* (BOL). **3320 (Montagu)**: Tweedside (–AB), 01 Oct. 1926, *Compton 3069* (BOL); Vrede, De Vlake (263), Anysberg (–BC), 01 Aug. 1987, *Forsyth 456* (NBG, PRE). **3418 (Simonstown)**: Kommetjie (–AB), Sep. 1945, *Bolus 1945* (BOL); near Glencairn (–AB), 04 Oct. 1928, *Hutchinson 639* (BOL); Hout Bay (–AB); 25 July 1942, *Compton 13338* (NBG); 17 Aug. 1940, *Compton 9154* (NBG); Bergvliet Farm (–AB), 15 Jul. 1916, *Purcell 90587* (SAM); Karbonkelberg (–AB), Jun. 1946, *Stokoe s.n.* (SAM); N of Wildevoelvlei (–AB), 24 Nov. 1983, *O'Callaghan 684* (NBG); lower slopes of Muizenberg mountains (–AB), 08 Jul. 1903, *Phillips 223* (NBG); Cape of Good Hope Nature Reserve, Klein Rondevlei between Klaasjager's River and Olifantsbos (–AB), 17 Oct. 1989, *Greuter 21862* (PRE); Witsand

(–AB), 30 Oct. 1927, *Smuts s.n.* (PRE); Steenbras River Mouth (–BB), Jul. 1938, *Walgate s.n.* (BOL). **3419 (Caledon)**: Caledon (–AB), 06 Aug. 1978, *Orchard 434* (NBG); Palmiet River mountains, Paardeberg (–AC), 24 May 1943, *Stokoe* (BOL); Kleinmond vlakte, N of vlei (–AC), 03 Oct. 1946, *de Vos 208* (NBG); 15 Aug. 1947, *de Vos 580* (NBG); 14 Sep. 1946, *de Vos 103* (NBG); Paardeberg, Stanford (–AD), 25 Sep. 1962, *Taylor s.n.* (NBG); Fernkloof Nature Reserve (–AD), 28 Aug. 1983, *Burman 1190* (BOL); Franskraal (–CB), 04 Jul. 1976, *Mostert s.n.* (NBG, PRE); Groot Hagelkraal (–DA), 16 Oct. 1986, *Esterhuysen 36367* (BOL); Bushman's River (–DA), Sep. 1935, *Lewis s.n.* (BOL); Hagelkraal (–DA), 16 Oct. 1986, *Cowling 3106* (NBG). **3420 (Bredasdorp)**: Bontebok Park (–AB), 08 Oct. 1950, *Compton 22172* (NBG); De Hoop, Hardevlakte, near gate between Hardevlakte and Moerasfontein (–AD), 21 Sep. 1984, *Van Wyk 1983* (NBG); De Hoop, Oulande (–AD), 20 Sep. 1984, *Morley 149* (NBG); De Hoop, Potberg Nature Reserve (–BC), 17 Oct. 1978, *Burgers 1419* (NBG). **3421 (Riversdale)**: Stillbay, Groot Jongensfontein Farm (–AA), 23 Aug. 1976, *Bohnen 3951* (NBG); Reisiesbaan Siding (–AB), 31 Oct. 1979, *Bohnen 7012* (NBG); Klein Jongensfontein, Jakkalskraal (–AB), 23 Jun. 1993, *Botes 368* (NBG); Wankoe se Rante, S of Riversdale (–AC), 06 Sep. 1975, *Oliver 5990* (NBG); 5 km from Albertinia on road to Ystervarkfontein, 1 km from Kleinfontein turnoff (–BA), without date, *Germishuizen 4234* (PRE); Ystervarkfontein (–BC), 20 Sep. 1989, *Bohnen 9038* (NBG). **3422 (Mosselbay)**: Mossel Bay (–AA), Aug. 1912, *Rogers 4137* (NBG).

2. *Gymnodiscus linearifolius* DC., Prodr. 6: 469 (1838). Type: South Africa [Northern Cape], Africa Capensi ad Klein Namaqualand [Boschemans-karoo and Groenrivier (*Harvey, 1865*)] [without date], *Drège s.n.* (G-DC, holo.; K-image!, SAM!, iso.)

Annual, rosetteform herb to 20 cm, glabrous at crown and in stem axils. Leaves basal, suberect-incurved, fusiform, 20–130 $\times$ 2–5 mm,

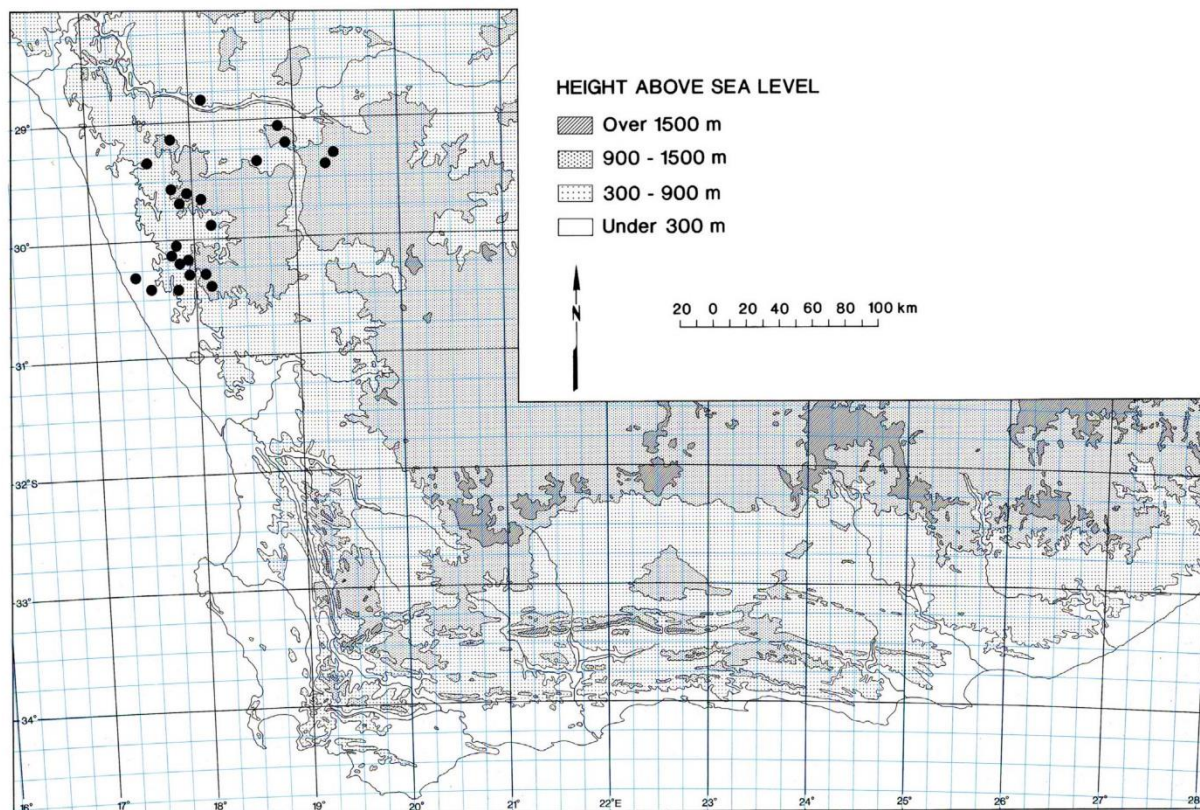


Fig. 5. Distribution of *G. linearifolius*.

mucronulate, succulent, green. *Peduncles* 2–6 mm diam., leaf-like cauline bracts linear, 3–15 × 2–3 mm., sessile, upper inflorescence bracts smaller, mucronulate 10–50 × 2–4 mm. *Capitula* in small cymose or sub-umbellate clusters aggregated into paniculate synflorescences; pedicels 5–45 mm long. *Involucre* campanulate to sub-globose, 4–10 mm diam.; involucre bracts 8 or 9, lanceolate to elliptic, 2.5–5.5 × 1.0–2.5 mm. *Ray florets*, 8 or 9, perianth tube 1.0–1.5 mm long, limb elliptic-ovate, 2.0–3.5 × 0.5–1.0 mm; ovary ellipsoid to narrowly oblong, glabrous; style included and branching just below mouth of tube. *Disc florets* 30, perianth ± 1.5 mm long, lobes ovate, 1–2 × 0.5 mm; anthers 1.0–1.5 mm long; ovary narrowly ellipsoid, glabrous. *Cypselas* ellipsoid-obvoid, 1.0–1.5 × 0.5–0.8 mm, glabrous. *Pappus* 1–2 mm long. (Figs. 1B and 4).

Distribution and ecology: A relatively local endemic of the Northern Cape, distributed from Aggenys in Bushmanland to Springbok and Kamieskroon in central Namaqualand (Fig. 5); occurring on sandy flats and slopes below 1000 m. Flowering is from late May to October.

Diagnosis: Distinguished from *G. capillaris* by the fusiform leaves (Fig. 4B) and larger capitula, 4–10 mm diam., with 8 or 9 involucre bracts and ray florets and 30 disc florets. The perianth tube in the ray florets is longer than in *G. capillaris*, 1–1.5 mm long, with the style included and branching below the mouth of the tube (Fig. 4D). The ray ovaries and cypselas are glabrous (Fig. 4D and F).

Additional specimens seen

South Africa: Northern Cape: **2818 (Warmbad)**: Goodhouse (–CC), 26 Sep. 1930, *Hennri* 2227, 2235 (PRE). **2917 (Springbok)**: Rietkloof, near Garies and Springbok (–BC), 02 Sep. 1897, *Schechter* 11183 (BOL, PRE); 5 km NW of Springbok, Klipdam (–DB), 06 Jul. 2013, *Helme* 8014 (NBG); Nababeep, near golf course (–DB), 20 Aug. 1980, *Le Roux* 2682 (BOL); near Springbok (–DB), Sep. 1939, *Gill* 54335 (SAM) **2918 (Gamoep)**: Wortel (–BB), 21 Jun. 1898, *Schlechter* 115 (BOL, PRE); Aggenys, about 10 miles (16 km) W of farm house (–BB), 04 Sep. 1971, *Wisura* 2231 (NBG); About 100 km W of Pofadder towards Springbok (–BC), 13 Sep. 1973, *Coetzee and Werger* 1755 (PRE); near Ratelkraal (–CA), 07 Sep. 1950, *Compton* 22004 (NBG); eastern Namaqualand, farm Rietfontein, alongside Brakrivier (–CC), 13 Sep. 2007, *Snijman* 2168 (NBG). **2919 (Pofadder)**: 40 miles (64 km) W of Pofadder (–AD), 24 May 1961, *Schliben* 8997 (BOL, PRE); foot of Gamsberg, 40 miles (64 km) WSW of Pofadder (–AD), 25 May 1961, *Leistner* 2506 (BOL). **3017 (Hondeklipbaai)**: Namakwa National Park, Farm Avontuur, S of Hondeklipbaai road (–AD), 11 Aug. 2006, *Koekemoer* 3278 (PRE); Kamieskroon (–BB), Sep. 1954, *de Vos* 1722 (NBG); Kamieskroon (–BB), 24 Aug. 1941, *Esterhuysen* 5697 (BOL, PRE); ± 10 km from Kamieskroon on road to Skilpad Nature Reserve (–BB), 23 Sep. 2015, *Manning & Magoswana* 3546 (NBG); Skilpad Wildflower Reserve, at turning point (–BB), 22 Jul. 1996, *Cruz* 50 (NBG); 3 miles (5 km) above Wallekraal (–BC), Oct. 1924, *Pillans* 18107 (BOL); north of Darter's grave (–BD), 07 Sep. 1950, *Maguire* 293 (NBG); Brakdam (–BD), 03 Sep. 1951, *Maguire* 964 (NBG); Skilpad

Nature Reserve, old fields S of homestead (–BB), 02 Jul. 1994, *Glass* 14 (NBG). **3018 (Kamiesberg)**: Around campsite between Bloudraai and Witwater (–AC), 14 Oct. 1981, *Le Roux and Ramsey* 779 (NBG); 10 km from Kamieskroon on road to Leliefontein (–AC), 24 Aug. 1995, *Rodriguez-Oubina & Cruces* 2053 (PRE).

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Othonna sonchifolia L. is an earlier name for *Senecio cymbalarifolius* L. (Asteraceae: Senecioneae)

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Background: Ongoing systematic studies in the African flora necessitate periodic nomenclatural adjustments and corrections.

Objectives: To effect requisite nomenclatural changes.

Method: Relevant literature was surveyed and type material located and examined.

Results: A nomenclatural correction is necessary in *Othonna* L. and *Senecio* L. (Asteraceae).

Conclusions: *Othonna sonchifolia* L. is recognised as the earliest name for *Senecio cymbalarifolius* (L.) Less. and the new combination *Senecio sonchifolius* (L.) J.C. Manning & Magoswana is provided for the species. *Othonna cymbalarifolia* is lectotypified and *Senecio hastifolius* (L.) Less. is reinstated from synonymy as a species distinct from *S. sonchifolius*.

Introduction

A recent revision of *Cineraria* L. by Cron, Balkwill & Knox (2006) included several taxa that were excluded from the genus as taxonomically uncertain. We have reviewed the types of some of these names as part of a revision of the geophytic species of *Othonna* L., and our examination of the type illustration of *Othonna sonchifolia* L. leads us to conclude that it is conspecific with *Senecio cymbalarifolius* L. making it the earliest available name for this taxon.

Othonna sonchifolia L. (Linnaeus 1753) is based on an engraving in Breyne's (1739) *Prodromi fasciculi rariorum plantarum primus et secundus*, '*Jacobaea, sonchi folio, flore purpureo amplo, africana*' (Figure 1). This illustration depicts a tuberous-rooted herb with lyrate basal leaves, ovate cauline leaves and two pedunculate, radiate capitula with uniseriate, oblong involucre bracts. Johann Breyne (1680–1764) was a German botanist, palaeontologist, zoologist and entomologist. His illustration of *O. sonchifolia* is derived from a living plant sent to Europe from the Cape of Good Hope by Heinrich Oldenland (1663–1697), a German physician, botanist and land surveyor (Glen & Germishuizen 2010).

Othonna sonchifolia was subsequently transferred to the genus *Cineraria* L. as *Cineraria sonchifolia* (L.) L. (Linnaeus 1763) and later to the genus *Doria* Thunb. as *Doria sonchifolia* (L.) Thunb. (Thunberg 1800). This latter transfer is inexplicable as Thunberg (1800) distinguished *Doria* from allied genera by its discoid heads, whereas those of *O. sonchifolia* are clearly radiate. This confusion was evident to Candolle (1838:309), who treated *C. sonchifolia* as an uncertain species in *Cineraria*. The species was entirely ignored by Harvey (1865) in his account of the family in southern Africa, and the name passed into obscurity until it was highlighted by Cron et al. (2006). Candolle (1838) evidently overlooked the fact that Linnaeus (1763) had originally published the name *O. sonchifolia* L. (1753), thereby rendering his (Candolle's) later new species *O. sonchifolia* DC. (1838) an illegitimate homonym (McNeil et al. 2012: Art. 53). This name was based on a collection made by Carl Zeyher (1799–1858) around Stellenbosch, South Africa, and is currently in use for a radiate, yellow-flowered species of *Othonna* from the Western Cape (Goldblatt & Manning 2000; Harvey 1865; Manning & Goldblatt 2012).

Two other names are relevant here. *Othonna cymbalarifolia* L. (1760), like *O. sonchifolia*, was based on plants collected by Oldenland (Figure 2). This taxon was later transferred to *Senecio* by Lessing (1832) and then by Candolle (1838) to the new genus *Brachyrhynchos* DC., a small genus of rather disparate elements that were distinguished from *Senecio* by their shortly beaked cypselas. *Brachyrhynchos* was not recognised by later authors, including Harvey (1865), who followed Lessing (1832) in treating the species in *Senecio*. *Cineraria hastifolia* L. (Linnaeus 1782), based on an unlocalised collection of Anders Sparrmann's (1748–1820) from the Cape of Good Hope (Figure 3),

was also transferred to *Senecio* by Lessing (1832), where it has since remained, initially as a distinct species (Candolle 1838) but later as a variety of *S. cymbalarifolius* (L.) Less. (Harvey 1865).

As circumscribed by Harvey (1865) and subsequent authors, *S. cymbalarifolius* is a polymorphic, tuberous pyrophyte with petiolate basal leaves and smaller, sessile cauline leaves.



Source: Breyn, J., 1739, *Prodomi fasciculi rariorum plantarum primus et secundus, etc.*, Danzig

FIGURE 1: Iconotype of *Othonna sonchifolia* L. in Johann Breyn *Prodomi fasciculi rariorum plantarum primus et secundus*: 31 t. 21, f.1 (1739).

The blade of the basal leaves is variously sagittate to reniform or lyrate and pinnatisect, often purple beneath, and either subglabrous or roughly hairy. The capitula are radiate, either purple or white, and solitary or few on scaly peduncles, rarely grouped in lax corymbs. The involucre bracts are few, and unusually broad for *Senecio*, somewhat resembling those in *Othonna*. The species is restricted to southwestern South Africa, from the Cederberg to Bredasdorp (Goldblatt & Manning 2000; Manning & Goldblatt 2012).

Among the material of *Senecio/Brachyrhynchos cymbalarifolius* that was available to him, Candolle (1838) distinguished various combinations of leaf shape and corolla colour as separate varieties, distinguishing plants with lyrate-pinnatisect leaves and 'yellow' (actually white or cream-coloured) florets as var. *flavus*, those with lyrate-pinnatisect leaves and purple florets as var. *purpureus*, and those with suborbicular or reniform leaves and purple florets as var. *rotundifolius*. These distinctions were maintained by Harvey (1865), who included *S. hastifolius* as a fourth variety, var. *hastifolius*, distinguished by its deeply 3- to 5-lobed or pedatifid leaves and yellowish (again actually white or cream-coloured) florets. Both Candolle (1838) and Harvey (1865) had access to very few specimens. We have now examined many more collections and have studied both *S. cymbalarifolius* and *S. hastifolius* in the wild at several localities on and around the Cape Peninsula.

Materials and methods

We examined the types as well as all relevant material from Bolus Herbarium (BOL), Compton Herbarium (NBG) and South African Museum (SAM) [acronyms following Thiers (2015)]. We also studied wild populations in the field on the Cape Peninsula and on the Drakenstein Mountains.

Results

Senecio cymbalarifolius is one of three evidently allied geophytic species with distinctive tuberous rootstock and annual stems with petiolate basal leaves, treated by Harvey (1865) in his



FIGURE 2: Original material of *Othonna cymbalarifolia* L. South Africa, 'Cap Bonae Spei', without date, Oldenland s.n. (G-herb. Burm.). (a), G00818193 [= *Senecio cymbalarifolius* var. *cymbalarifolius*]; (b), G00818194 [= *S. cymbalarifolius* var. *hastifolius*]; (c), G00818195 (lectotype, designated here) [= *S. cymbalarifolius* var. *cymbalarifolius*]; (d), G00818196 [= *S. cymbalarifolius* var. *cymbalarifolius*].



FIGURE 3: Holotype of *Cineraria hastifolia* L. South Africa, 'Cap. Bonae Spei', Sparrmann s.n., Herb. Linn. No. 1000.34 (LINN).

informal group *Paucifolii*. The group comprises *S. cordifolius* L.f., with cordate to ovate basal leaves with finely toothed, revolute margins and bright yellow, radiate capitula; *S. cymbalarifolius*, with polymorphic foliage with sagittate to reniform or lyrate to pinnatisect basal leaves and purple or white, radiate capitula; and *S. incertus* DC., which differs from *S. cymbalarifolius* in its discoid capitula (Harvey 1865; Manning & Goldblatt 2012). All three species are endemic to the Core Cape Floristic Region.

Senecio cymbalarifolius sensu Harvey (1865) is the most variable of the three species. Northern populations of *S. cymbalarifolius*, from the Cederberg and Cold Bokkeveld, have consistently orbicular basal leaves, sometimes with a pair of small lateral leaflets, and purple capitula. Populations from south of Ceres to the Cape Peninsula and Bredasdorp, however, are highly polymorphic in their foliage and in the colour of the florets. The colour of the florets varies among populations from the Cape Peninsula to Bredasdorp, with both purple and white-flowered plants of the various leaf morphs co-occurring at several localities. Significantly, flower colour also varies within populations and leaf morphs. Thus, several collections [e.g. Boucher 1890, 1891 (NBG)] from Kogelberg comprising individuals with consistently orbicular leaves with a pair of small lateral

leaflets have florets that are either purple (Boucher 1890) or white (Boucher 1891). It is thus clear that floret colour is not taxonomically significant in this species. There is also a continuous gradation in leaf morphology from simple, suborbicular blades to pinnatisect blades, sometimes within a single individual. Among plants with pinnatisect leaves, the terminal lobe is always at least twice as large as the lateral lobes and coarsely toothed. From the inter- and intrapopulation variation that we have seen, we conclude that there is no merit in maintaining a taxonomic distinction among vars. *flavus*, *purpureus* and *rotundifolius*.

This is not so in the case of *S. cymbalarifolius* var. *hastifolius*, however. We have examined several populations of plants corresponding to var. *hastifolius* and var. *purpureus* on the Cape Peninsula. In all instances, these populations were in close proximity to one another but we found no intermediates between them. Among the Cape Peninsula populations, plants of var. *hastifolius* are invariably white-flowered whereas those of var. *purpureus* are consistently purple-flowered. The two variants also occupy different ecological niches, with var. *purpureus* occurring on damp, rocky, often S-facing slopes or in the lee of large sandstone boulders, and var. *hastifolius* restricted to flat seepages or vleis on sandy plateaus. Examination of all available herbarium material confirms the morphological distinction in the foliage between plants of var. *hastifolius* and other forms of *S. cymbalarifolius*, as well as the ecological separation between them. The distinction in floret colour is not evident elsewhere across the range of these two varieties, however, and both occur as purple- and white-flowered plants.

Our observations on morphology and ecology lead us to conclude that *S. cymbalarifolius* var. *hastifolius* is correctly recognised as a species distinct from *S. cymbalarifolius*, and we accordingly resurrect the name at species rank.

Oldenland's type material of *Cineraria cymbalarifolius* consists of four herbarium sheets in the Burmann Herbarium in Geneva (Figure 2A–D). One of these, G00818193 (Figure 2A), bears two plant specimens; another, G00818194 (Figure 2B), bears three plant specimens; and the remaining two sheets, G00818195 (Figure 2C) and G00818196 (Figure 2D), bear just a single plant specimen each. All four sheets bear annotations in Oldenland's hand but just one of them, G00818195 (Figure 2C), bears the polynomial *Jacobaea cymbalariefolia biflora*. This collection, which we accordingly designate as the lectotype, matches our narrower circumscription of *S. cymbalarifolius*, as do the two sheets G00818193 and G00818196. The fourth sheet, G00818194, represents the plants that we treat here as *S. hastifolius*. Our identification of the specimens on these four sheets as representing these two separate species is borne out by corresponding determination labels for '*Senecio cymbalarifolius* (L.) Less.' and '*Senecio hastifolius* (L.f.) [sic.] Less.' that were affixed to the specimens in June 1929 by the South African botanist C.A. Smith (1893–1956).

It is possible or indeed likely that the type of *O. sonchifolia* was cultivated from tubers from one of the three populations

of plants of *S. cymbalarifolius* represented by Oldenland's herbarium specimens but this remains only a possibility. In any event, the illustration cannot be matched directly to one of the pressed specimens.

Taxonomic treatment

Senecio sonchifolius (L.) J.C. Manning & Magoswana, *comb. nov.* *Othonna sonchifolia* L., Sp. Pl. 2: 924 (1753) [non *O. sonchifolia* DC. (1838), nom. illeg. = *O. bulbosa* L. (1753)]. *Cineraria sonchifolia* (L.) L., Sp. Pl. ed. 2, 2: 1243 (1763). *Doria sonchifolia* (L.) Thunb., Nov. Gen. Pl.: 167 (1800). Type: South Africa, without precise locality or date, *Oldenland s.n.*, illustration in Breyn, Prodr. Fasc. Rar. Pl.: 31 t. 21, f.1 (1739).

Othonna cymbalarifolia L., Pl. Rar. Afr.: 24 (1760), *syn. nov.* *Cineraria cymbalarifolia* (L.) L., Sp. Pl. ed. 2, 2: 1242 (1763). *Senecio cymbalarifolius* (L.) Less., Syn. Gen. Compos.: 391 (1832). *Brachyrhynchos cymbalarifolius* (L.) DC., Prodr. 6: 438 (1838). Type: South Africa, 'Cap Bonae Spei', without date, *Oldenland s.n.* (G-herb. Burm. G00818194 – image!, lecto., designated here).

Brachyrhynchos cymbalarifolius var. *flavus* DC., Prodr. 6: 438 (1838), *syn. nov.* *Senecio cymbalarifolius* var. *flavus* (DC.) Harv. in Harv. & Sond., Fl. Cap. 3: 375 (1865). Type: South Africa, 'Draakensteinsberg' [Drakenstein Mtns]', without date, *Drège s.n.* (G-DC – image!, holo.).

Brachyrhynchos cymbalarifolius var. *purpureus* DC., Prodr. 6: 438 (1838), *syn. nov.* *Senecio cymbalarifolius* var. *purpureus* (DC.) Harv. in Harv. & Sond., Fl. Cap. 3: 375 (1865). Types: South Africa, 'Draakensteinsberg' [Drakenstein Mtns], without date, *Drège s.n.* (G-DC – image!, syn.); South Africa, 'in distr. urbis', without date, *Ecklon s.n.* (G-DC – image!, syn.).

Brachyrhynchos cymbalarifolius var. *rotundifolius* DC., Prodr. 6: 438 (1838), *syn. nov.* *Senecio cymbalarifolius* var. *rotundifolius* (DC.) Harv. in Harv. & Sond., Fl. Cap. 3: 375 (1865). Type: South Africa, 'Genadenthal [Genadendal]', without date, *Delessert s.n.* (G-DC – image!, holo.).

Senecio hastifolius (L.) Less., Syn. Gen. Compos.: 392 (1832); Thunb., Fl. Cap.: 672 (1823). *Cineraria hastifolia* L., Suppl. Pl.: 376 (1782). *Senecio cymbalarifolius* var. *hastifolius* (L.) Harv. in Harv. & Sond., Fl. Cap. 3: 375 (1865). Type: South Africa, 'Cap. Bonae Spei', without date, *Sparrmann s.n.* (LINN 1000.34 – image!, holo.).

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

J.M. was the project leader, L.M., A.M. and J.B. made conceptual contributions.

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